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30 March 2012

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Remediation Program Manager
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322 E. Inner Road
Otis ANG Base, MA 02542-5028

SUBJECT: AFCEE 4P08 FA8903-08-D-8769; Task Order 0300
MMR SPEIM/LTM/O&M Program
CDRL #A001j
Fuel Spill-28 2011 Summary Letter Report

Dear Mr. Davis:

The purpose of this Summary Letter Report (SLR) is to document the results of sampling activities conducted at the Fuel Spill-28 (FS-28) plume under the System Performance and Ecological Impact Monitoring (SPEIM) program during the 2011 calendar year. This deliverable contains no detailed assessment or evaluation of the results, but is a means of documenting all the actions completed under the FS-28 SPEIM program. The data collected under the SPEIM program are continually assessed and the results of these assessments are presented initially during the Technical Update Meetings and then through Technical Memoranda or Project Note deliverables, if warranted, based on the results of the data evaluation or to address particular plume issues.

This letter report includes a summary of the activities performed and the data collected for the FS-28 SPEIM program between 01 January 2011 and 31 December 2011. The FS-28 plume is defined as the extent of groundwater contaminated with ethylene dibromide (EDB), the FS-28 plume contaminant of concern (COC), at concentrations exceeding the Massachusetts Maximum Contaminant Level (MMCL) of 0.02 micrograms per liter ($\mu\text{g/L}$). The FS-28 extraction, treatment, and discharge (ETD) system was designed to treat a maximum of 750 gallons per minute (gpm). At the time of system startup on 14 October 1997, the ETD system consisted of one extraction well (69EW0001) with the goal of remediating the northern portion of the plume. On 06 April 1999, the remedial system was expanded with the startup of the shallow wellpoint (SWP) system which consisted of an array of 204 wellpoints. The SWP system was installed to intercept shallow EDB contaminated groundwater before it discharged to the Coonamessett River or associated cranberry bogs. During 2007, the FS-28 ETD system was further expanded through the installation of a second extraction well (69EW0002) to remediate a deeper leading edge lobe of the plume identified to the south of both 69EW0001 and the SWP system. Extraction well 69EW0002 came on-line on 11 December 2007. The extracted water is conveyed to the FS-28 treatment plant where it is treated by a granular activated carbon (GAC) system and discharged to the

Coonamessett River via two vertical riser pipes (i.e., bubblers). The FS-28 plume and treatment system are presented in [Figure 1](#).

On 07 November 2008, the SWP system was shutdown for an interim period while data gap investigative activities were being conducted (AFCEE 2009). The outcome of the 2008/2009 data gap investigation and optimization evaluation concluded that although the SWP system had been successful in remediating the FS-28 plume in this area, it is no longer effective in remediating the remaining residual EDB contamination near the SWPs. Consequently, the system was permanently shutdown on 25 February 2010 (AFCEE 2011c). During 2011, the FS-28 ETD system operated at a total flow rate of 625 gpm; 550 gpm extracted at 69EW0001 and 75 gpm at 69EW0002.

The Air Force Center for Engineering and the Environment (AFCEE) installed the FS-28 ETD system (including 69EW0001 and the SWP system) under time critical and non-time critical actions which became the selected alternative in the Final Record of Decision (ROD) (AFCEE 2000). The FS-28 remedial system has been modified since the ROD was signed in 2000 through the addition of extraction well 69EW0002 in 2007. This modification was not considered significant since the modifications were consistent with the cleanup strategy outlined in the 2000 ROD. A Final Explanation of Significant Differences (ESD) was submitted in September 2008 to document the planned Land Use Control (LUC) process at FS-28 and to update the three-step process (AFCEE 2008). A second ESD was submitted in September 2011 that clarified the inclusion of monitored natural attenuation as a component of the selected remedy, slightly modified the phrasing of the remedial action objectives, and updated the steps to achieve site closure (i.e., the three-step process) (AFCEE 2011a).

FS-28 SPEIM ACTIVITIES

The SPEIM program was developed to monitor plume changes and to ensure the effective operation of the AFCEE groundwater remediation systems at Massachusetts Military Reservation (MMR). These objectives are met through monitoring of selected media (i.e., groundwater, surface water) within and outside the plume boundaries, treatment plant monitoring, and groundwater flow and transport modeling. Activities completed for the FS-28 SPEIM program during 2011 include the following:

SPEIM Sampling Activities:

- Annual (January 2011 to March 2011) and semiannual (August 2011) groundwater sampling.
- Surface water sampling at the Coonamessett River during the cranberry growing season (June 2011 and August 2011).
- Annual sampling of the Coonamessett Water Supply Well (CWSW) sentry well (October 2011).
- One-time sampling of select monitoring wells to provide supplemental monitoring data to support plume characterization (69MW1501 in January 2011; 69PZ0020A and 69PZ0021A in February 2011).
- Monthly treatment system sampling (January 2011 through December 2011).

- Recording of daily average treatment system flow rates (January 2011 through December 2011).
- LUC Program private well sampling.

Groundwater and surface water locations sampled for the FS-28 SPEIM program in 2011 are presented in [Figure 2](#) and [Figure 3](#), respectively. The well construction and surface water location information is included in [Table 1](#). The current approved FS-28 SPEIM network is presented in the *Comprehensive Long Term Monitoring Plan*, which is available from AFCEE.

Groundwater analytical results are presented in [Table 2](#). [Table 3](#) contains the surface water analytical results. A map showing the distribution of EDB detections in groundwater in 2011 is included as [Figure 4](#). A comparison of compounds detected during 2011 in groundwater, surface water, and treatment plant samples to applicable standards is included in [Attachment A](#).

Drilling and Direct Push Activities:

No drilling or direct push activities were conducted in 2011 at FS-28.

Data Summary Report:

The data summary report for the analytical data reported in this SLR is included in [Attachment B](#).

Presentations:

Presentations for the FS-28 plume are listed in [Table 4](#).

Project Note Submittals:

The project notes related to activities conducted for the FS-28 plume under the SPEIM program in 2011 are included in [Attachment C](#).

Report Submittals:

- *Fuel Spill-28 2010 Summary Letter Report* submitted in March 2011 (AFCEE 2011c).
- Annual data transmittal of the monitoring results for the Coonamessett Water Supply Well sentry well submitted in November 2011.

Major Events and Optimizations:

Optimization activities are completed as part of the SPEIM program in order to improve the performance of the remedial systems and to improve the monitoring program. Monitoring data collected under the SPEIM program near 69EW0002 during 2010 suggested the plume width was increasing, and therefore it was concluded that the extent of hydraulic capture by this extraction well should be increased. Accordingly, the flow rate at 69EW0002 was increased from 50 gpm to 75 gpm on 07 October 2010. Performance monitoring data collected during 2011 indicate the increase in flow at 69EW0002 has been effective in improving plume capture (see *Fuel Spill-28 2011 Annual SPEIM Data Presentation Project Note* in [Attachment C](#) for more details).

During 2011, the FS-28 SPEIM surface water monitoring network was optimized. In summary, the monitoring network was reduced from 15 locations to 11 locations and the monitoring frequency was reduced from three sampling events per growing season, to two (June and August) at the remaining 11 locations. In addition, AFCEE's recreational beach surface water monitoring program was optimized during 2011 which resulted in the elimination of monitoring at Coonamessett Pond, Jenkins Pond, and Round Pond ([Figure 1](#)) (AFCEE 2011b).

As part of an optimization evaluation, AFCEE purchased a 20,000 pound (lb) load of virgin coconut shell-based GAC for use in a comparative test of performance at the FS-28 treatment system. This GAC bed was installed on 19 October 2011 and as of 31 December 2011 was still in the lag position. The performance of the coconut shell-based GAC will be compared against the historic performance of custom-segregated reactivated GAC which typically lasts two to three months in the lead position in the FS-28 treatment system. The results of this GAC optimization evaluation will be reported during 2012.

FS-28 REMEDIAL STATUS UPDATE

Analytical results for samples collected at the FS-28 treatment system are presented in [Table 5](#). Average weekly flow rates for the FS-28 extraction wells are presented in [Table 6](#). Treatment system operational downtimes or deviations (for events lasting two hours or longer) between January 2011 and December 2011 are summarized in [Table 7](#). Mass removal calculations through December 2011 for the FS-28 treatment system are presented in [Table 8](#).

The most recent plume shell for the FS-28 plume included data collected through June 2006 (AFCEE 2007). The 2006 FS-28 EDB plume shell is estimated to contain approximately 1.8 billion gallons of contaminated groundwater and 4.8 lbs of dissolved-phase EDB at concentrations above the MMCL.

The FS-28 ETD system removed approximately 0.246 lbs of EDB between January 2011 and December 2011. During this period, approximately 310 million gallons of groundwater were treated at the FS-28 plant. Since system startup in October 1997, the system has removed approximately 14.68 lbs of EDB through the treatment of approximately 4.9 billion gallons of groundwater.

The operation of the FS-28 remedial system used approximately 413 megawatt hours of electricity during 2011. Power plant air emissions associated with this power generation for 2011 and since system startup in October 1997 are presented in [Table 9](#). Green energy purchases and power production from AFCEE's wind turbines are incorporated into these air emissions data.

The FS-28 remedial system is currently operating according to the 2010 Scenario 01 pumping configuration; 69EW0001 at 550 gpm and 69EW0002 at 75 gpm. Groundwater transport modeling conducted in 2004 indicates that EDB at concentrations above the MMCL will be present in the main body of the FS-28 plume (i.e., north of 69EW0001) through approximately 2047 (AFCEE 2004). It should be noted that the FS-28 plume shell was not updated during 2011 and that groundwater transport modeling was not performed during 2011. Due to the complexity of the hydrogeology in the area of the leading edge lobes (south of 69EW0001), the groundwater model will not be used to

assess the fate and transport of this portion of the FS-28 plume. Rather, monitoring data collected under the SPEIM program will be used to evaluate the remedial system performance and to identify optimization opportunities for this lobe of the FS-28 plume. Through the SPEIM program, the Conceptual Site Model is routinely updated and the remedial system operation is continuously evaluated and optimized to reduce cleanup times, therefore the predicted timeframes presented in this section will most likely be decreased in future scenarios.

FS-28 SPEIM ACTIVITIES PLANNED FOR 2012

Activities currently planned for the FS-28 SPEIM program for 2012 include the following:

- Triennial, annual and semiannual (February 2012) and semiannual (August 2012) groundwater sampling.
- Annual sampling of the CWSW sentry well (October 2012).
- Coonamessett River surface water and irrigation system sampling during the 2012 cranberry growing season (June and August).
- Monitoring network and ETD system optimization evaluations (when appropriate).
- Synoptic water level measurements (as needed).
- FS-28 SPEIM data presentations.
- Monthly treatment system sampling (January 2012 through December 2012).
- Recording of daily average treatment system flow rates (January 2012 through December 2012).
- LUC Program private well verification surveys and sampling (as needed).

Mr. Jon Davis is the Air Force point of contact for this project and can be reached at (508) 968-4670, extension 4952.

Sincerely,

CH2M HILL



Patricia de Groot, P.G.
Program Manager

Attachments:

<u>Figure 1</u>	FS-28 Groundwater Plume and Treatment System
<u>Figure 2</u>	FS-28 Chemical Monitoring Locations - Groundwater
<u>Figure 3</u>	FS-28 Chemical Monitoring Locations - Surface Water
<u>Figure 4</u>	FS-28 2011 Ethylene Dibromide Detections in Groundwater
<u>Table 1</u>	FS-28 Well Construction and Surface Water Sampling Location Information
<u>Table 2</u>	FS-28 Groundwater Monitoring Results
<u>Table 3</u>	FS-28 Surface Water Monitoring Results
<u>Table 4</u>	FS-28 Meeting Presentations
<u>Table 5</u>	FS-28 Treatment Plant Sampling Results
<u>Table 6</u>	FS-28 Treatment System Flow Rates

Table 7	FS-28 Treatment System Downtime Summary
Table 8	FS-28 Treatment System Mass Removal Summary
Table 9	FS-28 Remedial System Electrical Consumption and Associated Air Emissions
Attachment A	Comparison of Detected Concentrations in FS-28 Groundwater, Surface Water, and Treatment Plant Samples to Applicable Groundwater and Surface Water Standards
Attachment B	FS-28 2011 SLR Data Summary Report
Attachment C	FS-28 Project Note

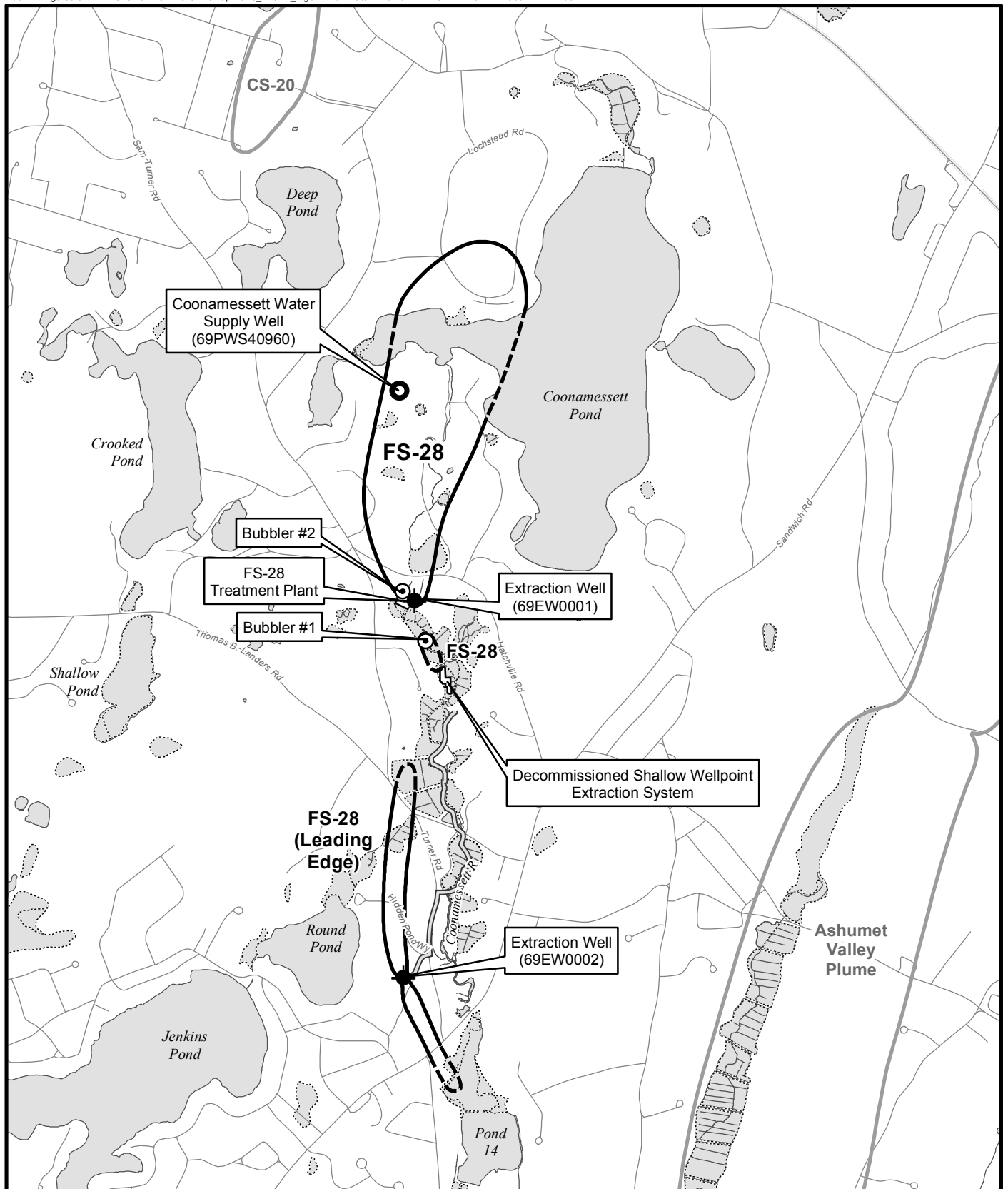
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FIGURES



Legend

- | | | | |
|--|--------------------------|--|--|
| | Extraction Well | | Plume Boundary (Dashed Where Inferred) |
| | Public Water Supply Well | | Other Plume Boundary (Dashed Where Inferred) |
| | Bubbler | | 69EW0002 Pipeline |
| | Bog/Wetland | | |

Data Source: AFCEE, February 2011, MMR-AFCEE Data Warehouse

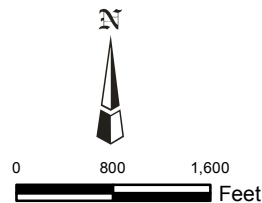
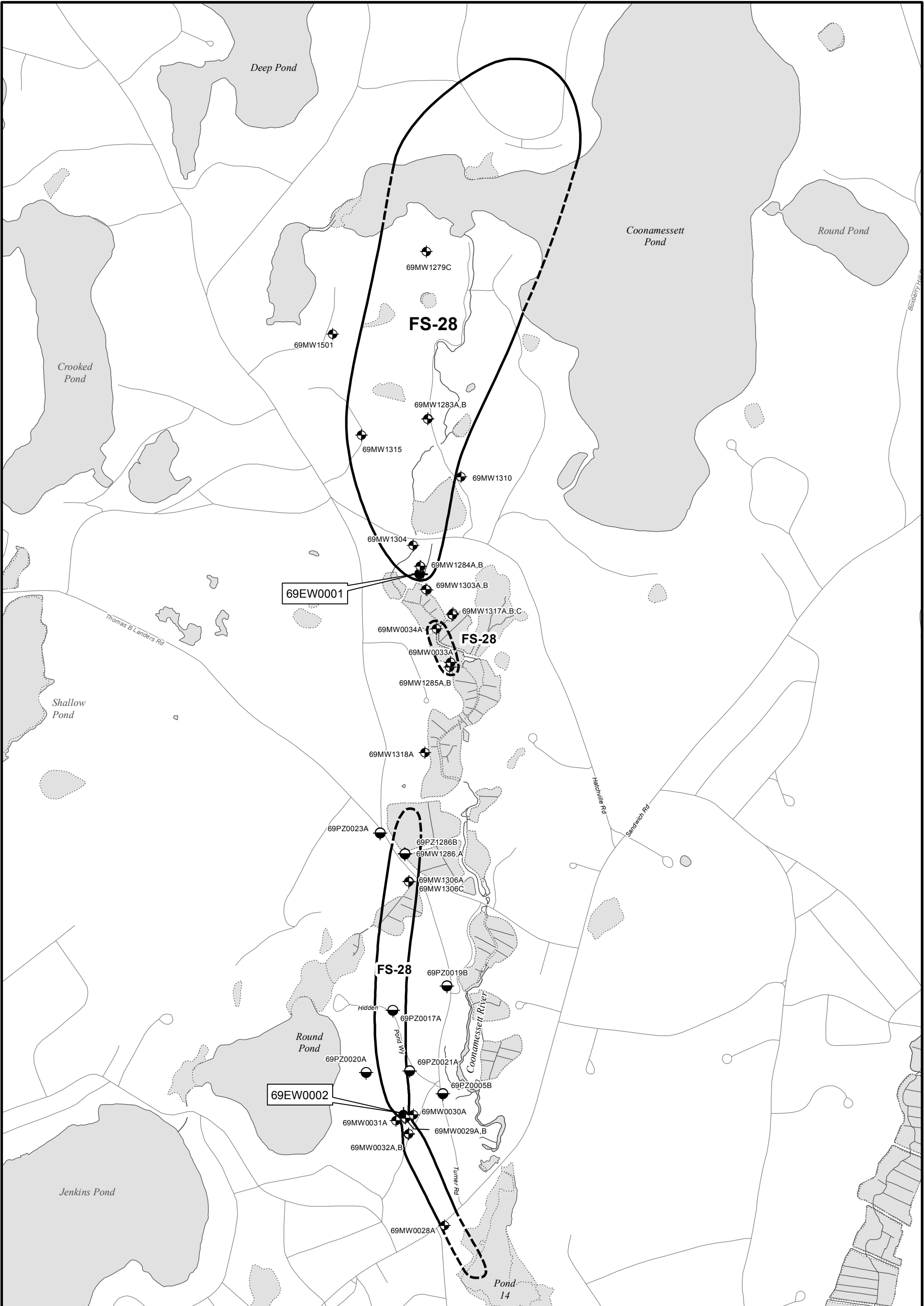


FIGURE 1

FS-28 GROUNDWATER PLUME AND TREATMENT SYSTEM

AFCEE - Massachusetts Military Reservation
FS-28 2011 Summary Letter Report

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Data Source: AFCEE, February 2012, MMR-AFCEE Data Warehouse

Legend

- | | | | |
|--|-----------------|--|--|
| | Monitoring Well | | Plume Boundary (Dashed Where Inferred) |
| | Piezometer | | Bog/Wetland |
| | Extraction Well | | |

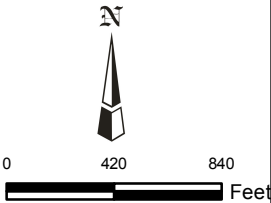


FIGURE 2

FS-28 CHEMICAL MONITORING LOCATIONS - GROUNDWATER
AFCEE - Massachusetts Military Reservation
FS-28 2011 Summary Letter Report

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Data Source: AFCEE, February 2012, MMR-AFCEE Data Warehouse

Legend

- ⊙ Surface Water Sampling Location
- Plume Boundary (Dashed Where Inferred)
- Bog/Wetland

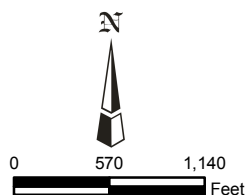
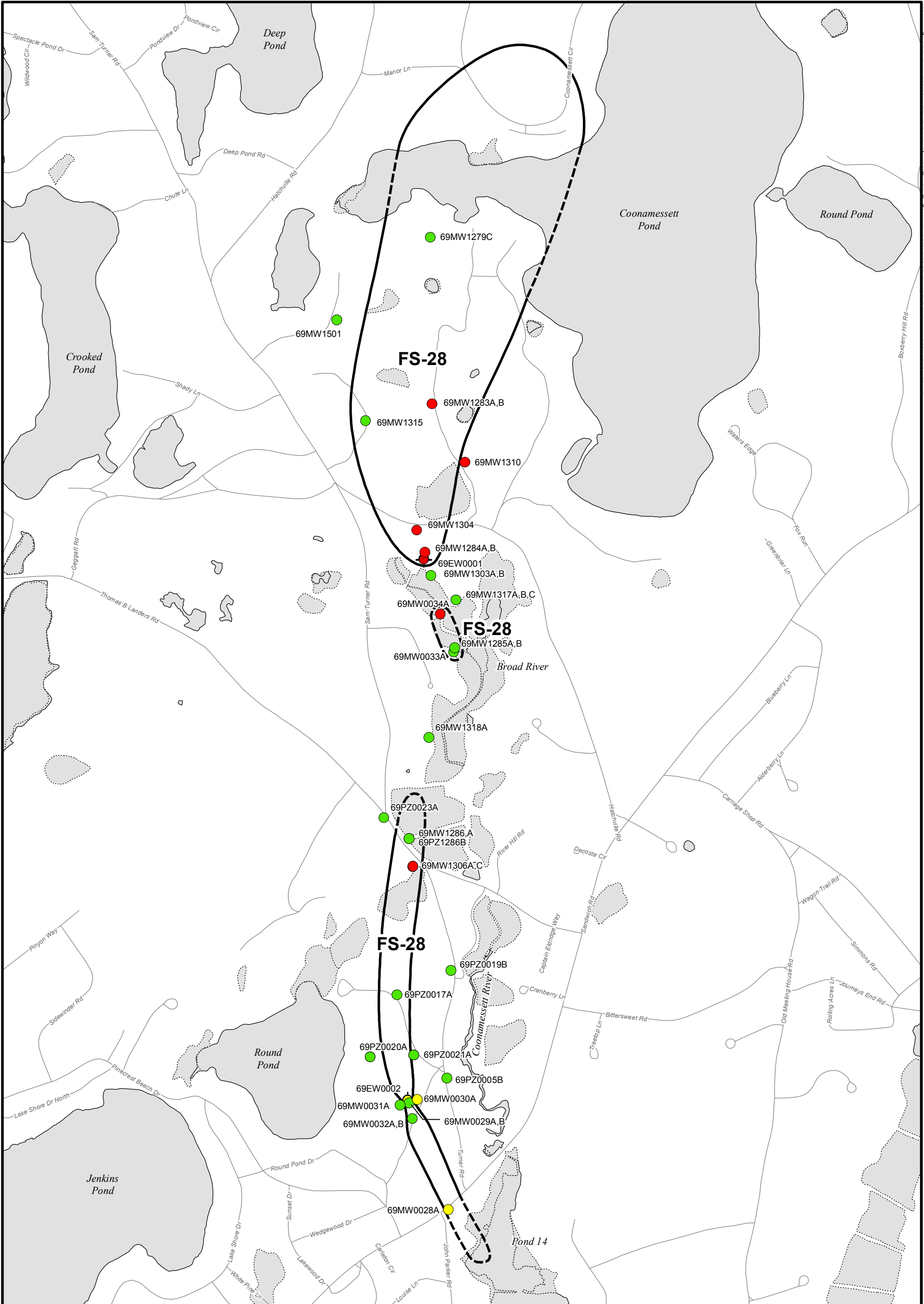


FIGURE 3

FS-28 CHEMICAL MONITORING LOCATIONS - SURFACE WATER

AFCEE - Massachusetts Military Reservation
FS-28 2011 Summary Letter Report

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Legend

- Extraction Well
- Plume Boundary (Dashed Where Inferred)
- Bog/Wetland

Contaminant Detections in Groundwater:

- Detection Above MMCL
- Detection Below or At MMCL
- No Detection

Data Source: AFCEE, February 2012, MMR-AFCEE Data Warehouse

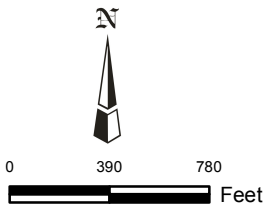


FIGURE 4

**FS-28 2011 ETHYLENE DIBROMIDE
DETECTIONS IN GROUNDWATER**
AFCEE - Massachusetts Military Reservation
FS-28 2011 Summary Letter Report

TABLES

Table 1
FS-28 Well Construction and Surface Water Sampling Location Information
FS-28 2011 Summary Letter Report

Location	Northing (ft)	Easting (ft)	Surface Elevation (ft msl)	Measuring Point Elevation (ft msl)	Total Well Depth (ft bgs)	Top Screen Elevation (ft msl)	Bottom Screen Elevation (ft msl)	Screen Length (ft)
69EW0001	224250	853233	31	30.32	207	-149.22	-169.55	20.33*
69EW0002	219893	853102	40	33.85	302	-132.10	-148.10	16
69MW0028A	219006	853432	28	27.47	207	-66.99	-71.99	5
69MW0029A	219866	853116	39	38.95	171	-126.56	-131.56	5
69MW0029B	219867	853121	39	39.21	136	-89.85	-94.85	5
69MW0030A	219894	853183	39	38.74	131	-86.27	-91.27	5
69MW0031A	219848	853042	40	40.12	268	-114.32	-119.32	5
69MW0032A	219738	853143	47	46.14	260	-126.28	-131.28	5
69MW0032B	219743	853144	46	45.91	255	-93.59	-98.59	5
69MW0033A	223500	853476	28	27.53	26	7.92	2.92	5
69MW0034A	223807	853367	29	28.34	148	-111.90	-116.90	5
69MW1279C	226842	853287	47	49.12	155	-102.99	-107.99	5
69MW1283A	225500	853301	37	38.13	185	-135.50	-138.50	3
69MW1283B	225494	853297	36	38.46	261	-183.60	-188.60	5
69MW1284A	224304	853243	32	33.44	225	-177.50	-182.50	5
69MW1284B	224309	853238	32	33.80	278	-213.40	-218.40	5
69MW1285A	223533	853482	28	30.44	68	-31.90	-36.90	5
69MW1285B	223537	853484	28	30.49	205	-151.80	-156.80	5
69MW1286	221997	853115	28	27.19	195	-152.50	-157.50	5
69MW1286A	221996	853110	28	27.20	209	-99.74	-104.74	5
69MW1303A	224117	853292	31	30.68	278	-171.80	-176.80	5
69MW1303B	224123	853284	31	30.94	278	-211.60	-218.30	7
69MW1304	224480	853179	35	36.84	273	-178.50	-183.50	5
69MW1306A	221775	853148	26	28.38	245	-79.24	-84.24	5
69MW1306C	221772	853145	26	25.48	147	-115.27	-120.27	5
69MW1310	225029	853565	33	34.91	263	-197.20	-207.20	10
69MW1315	225364	852764	59	59.03	300	-173.70	-178.70	5
69MW1317A	223919	853494	31	30.22	245	-139.44	-144.44	5
69MW1317B	223931	853501	31	30.34	146	-108.23	-113.05	5
69MW1317C	223920	853499	31	30.22	93	-57.20	-62.20	5
69MW1318A	222810	853276	28	27.03	220	-127.48	-132.48	5
69MW1501	226177	852532	64	63.06	94	-25.06	-30.06	5
69PZ0005B	220066	853420	26	25.78	46	-13.95	-18.95	5
69PZ0017A	220736	853018	46	45.60	186	-131.28	-136.28	5
69PZ0019B	220933	853452	28	27.46	48	-10.23	-15.23	5
69PZ0020A	220237	852802	64	63.44	181	-112.72	-117.72	5
69PZ0021A	220251	853154	34	34.13	162	-122.41	-127.41	5
69PZ0023A	222164	852914	35	34.34	176	-135.55	-140.55	5
69PZ1286B	221997	853115	27	27.11	100	-67.54	-72.54	5
69SW0006	224248	853012	N/A	N/A	N/A	N/A	N/A	N/A
69SW0010	223613	853584	N/A	N/A	N/A	N/A	N/A	N/A
69SW0019	223033	853534	N/A	N/A	N/A	N/A	N/A	N/A
69SW0046	222272	853626	N/A	N/A	N/A	N/A	N/A	N/A
69SW0048	220889	853688	N/A	N/A	N/A	N/A	N/A	N/A
69SW0049	219473	853890	N/A	N/A	N/A	N/A	N/A	N/A
69SW0060	221766	853529	N/A	N/A	N/A	N/A	N/A	N/A
69SW0527	218217	854248	N/A	N/A	N/A	N/A	N/A	N/A
69SW2001	222314	853493	N/A	N/A	N/A	N/A	N/A	N/A
69SW2002	221764	853216	N/A	N/A	N/A	N/A	N/A	N/A
69SW2007	220644	853739	N/A	N/A	N/A	N/A	N/A	N/A

Data Source: AFCEE, February 2012, MMR-AFCEE Data Warehouse

Note:

* Extraction well screen length shortened between 03 and 11 June 2009 through installation of packers as a result of optimization.

Key:

bgs = below ground surface

msl = mean sea level

FS-28 = Fuel Spill-28

N/A = information not applicable

ft = feet

Table 2
FS-28 Groundwater Monitoring Results
FS-28 2011 Summary Letter Report

Location	Date	Laboratory Analyses	Water Quality Parameters					
		EDB (µg/L) MMCL ¹ = 0.02	Temp (°C)	pH (std)	DO (mg/L)	SpC (µS/cm)	ORP (mV)	Turbidity (NTU)
69EW0001	1/25/2011	0.151	*	*	*	*	*	*
69EW0001	2/25/2011	0.124	*	*	*	*	*	*
69EW0001	3/25/2011	0.121	*	*	*	*	*	*
69EW0001	4/25/2011	0.117	*	*	*	*	*	*
69EW0001	5/25/2011	0.093	11.28	6.00	3.65	95	174.4	0.0
69EW0001	6/27/2011	0.125	*	*	*	*	*	*
69EW0001	7/27/2011	0.084	*	*	*	*	*	*
69EW0001	8/25/2011	0.091	*	*	*	*	*	*
69EW0001	9/27/2011	0.090 J	*	*	*	*	*	*
69EW0001	10/27/2011	0.094	*	*	*	*	*	*
69EW0001	11/28/2011	0.068	11.52	5.95	3.59	91	189.9	0.0
69EW0001	12/27/2011	0.075	*	*	*	*	*	*
69EW0002	1/25/2011	0.047	*	*	*	*	*	*
69EW0002	2/25/2011	0.049	*	*	*	*	*	*
69EW0002	3/25/2011	0.041	*	*	*	*	*	*
69EW0002	4/25/2011	0.030	*	*	*	*	*	*
69EW0002	5/25/2011	0.031	11.58	6.36	1.83	93	148.4	0.0
69EW0002	6/27/2011	0.014	*	*	*	*	*	*
69EW0002	7/27/2011	0.021	*	*	*	*	*	*
69EW0002	8/25/2011	0.022	*	*	*	*	*	*
69EW0002	9/27/2011	0.020	*	*	*	*	*	*
69EW0002	10/27/2011	0.020	*	*	*	*	*	*
69EW0002	11/28/2011	0.015	11.19	6.48	1.82	88	167.6	0.1
69EW0002	12/27/2011	0.018	*	*	*	*	*	*
69MW0028A	2/18/2011	0.011	--	--	--	--	--	--
69MW0029A	2/18/2011	ND	--	--	--	--	--	--
69MW0029A	8/15/2011	ND	--	--	--	--	--	--
69MW0029B	2/18/2011	0.014	--	--	--	--	--	--
69MW0029B	8/15/2011	ND	--	--	--	--	--	--
69MW0030A	2/18/2011	0.017	--	--	--	--	--	--
69MW0030A	8/15/2011	0.012 J	--	--	--	--	--	--
69MW0031A	2/18/2011	ND	--	--	--	--	--	--
69MW0031A	8/15/2011	ND	--	--	--	--	--	--
69MW0032A	2/18/2011	ND	--	--	--	--	--	--
69MW0032A	8/15/2011	ND	--	--	--	--	--	--
69MW0032B	2/18/2011	ND	--	--	--	--	--	--
69MW0032B	8/15/2011	ND	--	--	--	--	--	--
69MW0033A	2/18/2011	ND	--	--	--	--	--	--
69MW0034A	2/18/2011	0.039	--	--	--	--	--	--
69MW1279C	10/11/2011	ND	--	--	--	--	--	--
69MW1283A	2/17/2011	0.4	--	--	--	--	--	--
69MW1283B	2/17/2011	1.1	--	--	--	--	--	--
69MW1284A	2/17/2011	0.472	--	--	--	--	--	--
69MW1284B	2/22/2011	0.9	--	--	--	--	--	--
69MW1285A	2/22/2011	ND	--	--	--	--	--	--
69MW1285B	2/22/2011	ND	--	--	--	--	--	--
69MW1286	2/22/2011	ND	--	--	--	--	--	--
69MW1286A	2/22/2011	ND	--	--	--	--	--	--
69MW1303A	2/22/2011	ND	--	--	--	--	--	--

Table 2
FS-28 Groundwater Monitoring Results
FS-28 2011 Summary Letter Report

Location	Date	Laboratory Analyses	Water Quality Parameters					
		EDB (µg/L) MMCL ¹ = 0.02	Temp (°C)	pH (std)	DO (mg/L)	SpC (µS/cm)	ORP (mV)	Turbidity (NTU)
69MW1303B	2/22/2011	ND	--	--	--	--	--	--
69MW1304	2/17/2011	0.811	--	--	--	--	--	--
69MW1306A	2/22/2011	0.026	--	--	--	--	--	--
69MW1306C	3/14/2011	0.021	--	--	--	--	--	--
69MW1310	2/17/2011	0.104	--	--	--	--	--	--
69MW1315	3/14/2011	ND	--	--	--	--	--	--
69MW1317A	2/17/2011	ND	--	--	--	--	--	--
69MW1317B	2/17/2011	ND	--	--	--	--	--	--
69MW1317C	2/17/2011	ND	--	--	--	--	--	--
69MW1318A	2/22/2011	ND	--	--	--	--	--	--
69MW1501	1/21/2011	ND	--	--	--	--	--	--
69PZ0005B	3/14/2011	ND	--	--	--	--	--	--
69PZ0017A	2/18/2011	ND	--	--	--	--	--	--
69PZ0017A	8/15/2011	ND	--	--	--	--	--	--
69PZ0019B	2/23/2011	ND	--	--	--	--	--	--
69PZ0020A	2/23/2011	ND	--	--	--	--	--	--
69PZ0021A	2/23/2011	ND	--	--	--	--	--	--
69PZ0023A	3/14/2011	ND	--	--	--	--	--	--
69PZ1286B	3/14/2011	ND	--	--	--	--	--	--

Data Source: AFCEE, February 2012, MMR-AFCEE Data Warehouse

Notes:

1. MMCL from Massachusetts Department of Environmental Protection (MassDEP) web page, <http://www.mass.gov/dep/water/dwstand.pdf>.

Bold values represent EDB concentrations above the MMCL.

--: Sample collected through use of passive diffusion bag sampler; water quality parameter collection not performed.

*: Water quality parameters collected semiannually from 69EW0001 and 69EW0002.

Key:

°C = degrees Celsius

DO = dissolved oxygen

EDB = ethylene dibromide

FS-28 = Fuel Spill-28

J = estimated concentration

mg/L = milligrams per liter

MMCL = Massachusetts Maximum Contaminant Level

mV = millivolts

ND = not detected

NTU = nephelometric turbidity units

ORP = oxidation-reduction potential

SpC = specific conductance

std = standard units

Temp = temperature

µg/L = micrograms per liter

µS/cm = microsiemens per centimeter

Table 3
FS-28 Surface Water Monitoring Results
FS-28 2011 Summary Letter Report

Location	Date	Laboratory Analyses	Water Quality Parameters					
		EDB ^{1,2} (µg/L)	Temp (°C)	pH (std)	DO (mg/L)	SpC (µS/cm)	ORP (mV)	Turbidity (NTU)
69SW0006	6/7/2011	ND	19.66	6.25	7.77	95	139.4	0
69SW0006	8/11/2011	ND	21.48	6.38	8.24	86	110.6	0.7
69SW0010	6/7/2011	ND	19.55	6.23	7.92	96	136.7	0
69SW0010	8/11/2011	ND	20.79	6.43	8.54	88	100.7	0.4
69SW0019	6/7/2011	ND	19.58	6.21	8.74	99	126.9	0
69SW0019	8/11/2011	ND	20.92	6.38	8.54	90	93.7	1.1
69SW0046	6/7/2011	ND	20.11	6.2	10.22	95	116.6	0
69SW0046	8/11/2011	ND	20.7	6.33	8.3	90	73.1	1.1
69SW0048	6/7/2011	ND	18.64	6.39	8.73	100	100.7	0.8
69SW0048	8/11/2011	ND	19.59	6.68	8.31	90	142.4	0.1
69SW0049	6/7/2011	ND	16.85	6.77	8.72	103	162	0
69SW0049	8/11/2011	ND	17.96	6.94	8.03	94	138.9	0.8
69SW0060	6/7/2011	ND	20.48	6	13.37	142	152.9	5.1
69SW0060	8/11/2011	ND	20.78	6.25	9.64	129	130.2	1.2
69SW0527	6/7/2011	ND	21.56	7.72	11.48	106	154.3	4.8
69SW0527	8/11/2011	ND	23.87	7.07	4.53	97	137.5	0.9
69SW2001	6/7/2011	ND	19.6	5.98	8.87	106	114	42.5
69SW2001	8/11/2011	ND	20.27	6.2	5.33	115	53.4	102.7
69SW2002	6/7/2011	ND	20.4	5.91	3.96	211	132.2	20.9
69SW2002	8/11/2011	ND	25.66	6.52	8.19	88	96.4	179.3
69SW2007	6/7/2011	BRL	13.7	6.25	11.06	153	199	1.2
69SW2007	8/11/2011	ND	15.08	6.42	9.43	127	174.2	0.5

Data Source: AFCEE, February 2012, MMR-AFCEE Data Warehouse

Notes:

1. EDB screening-level risk based concentration for imminent human health risk (10^{-3} risk) = 7.71 µg/L: Preliminary Screening-Level Human Health Risk Evaluation for Exposure to FS-28 Surface Water; Appendix D of *Final Fuel Spill-28 2002 Annual System Performance and Ecological Impact Monitoring Report*, dated March 2003.
2. EDB screening-level ecological benchmark = 31 µg/L: *Final Ethylene Dibromide Derivation of Aquatic Screening Benchmarks*, dated November 1998.

Key:

BRL - below reporting limit
°C = degrees Celsius
DO = dissolved oxygen
EDB = ethylene dibromide
FS-28 = Fuel Spill-28

mg/L = milligrams per liter
mV = millivolts
ND = not detected
NTU = nephelometric turbidity units
ORP = oxidation-reduction potential

SpC = specific conductance
std = standard units
Temp = temperature
µg/L = micrograms per liter
µS/cm = microsiemens per centimeter

Table 4
FS-28 Meeting Presentations
FS-28 2011 Summary Letter Report

Technical Update Meetings

11 May 2011	FS-28 2011 Annual SPEIM Data Presentation
29 September 2011	FS-28 2011 Annual SPEIM Data Presentation Follow-Up
29 September 2011	FS-28 and Petroleum Fuel Storage Area Vapor Intrusion Evaluation Preview

MMR Cleanup Team (MMRCT)

12 October 2011	FS-28 Plume Update
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SMB Meetings

No presentations

Conferences

No presentations

Table 5
FS-28 Treatment Plant Sampling Results
FS-28 2011 Summary Letter Report

Month of Event	Sample Date	Loc ID	Sample Location	Laboratory Analyses	Water Quality Parameters					
				EDB (µg/L) MMCL = 0.02	Temp (°C)	pH (std)	DO (mg/L)	SpC (µS/cm)	ORP (mV)	Turbidity (NTU)
Carbon was exchanged in CF101B on 13 January 2011. Following replacement, CF101A was aligned as lead and CF101B as lag.										
February	25-Jan-11	69EW0001	69EW0001 Influent	0.151	--	--	--	--	--	--
		69EW0002	69EW0002 Influent	0.047	--	--	--	--	--	--
		69PLT01002	Intermediate (101A)	BRL	--	--	--	--	--	--
		69PLT01010	Effluent	ND	--	--	--	--	--	--
March	25-Feb-11	69EW0001	Deep Well Influent	0.124	--	--	--	--	--	--
		69EW0002	69EW0002 Influent	0.049	--	--	--	--	--	--
		69PLT01002	Intermediate (101A)	0.017	--	--	--	--	--	--
		69PLT01010	Effluent	ND	--	--	--	--	--	--
Carbon was exchanged in CF101A on 09 March 2011. Following replacement, CF101B was aligned as lead and CF101A as lag.										
April	25-Mar-11	69EW0001	Deep Well Influent	0.121	--	--	--	--	--	--
		69EW0002	69EW0002 Influent	0.041	--	--	--	--	--	--
		69PLT01003	Intermediate (101B)	BRL	--	--	--	--	--	--
		69PLT01010	Effluent	ND	--	--	--	--	--	--
May	25-Apr-11	69EW0001	Deep Well Influent	0.117	--	--	--	--	--	--
		69EW0002	69EW0002 Influent	0.030	--	--	--	--	--	--
		69PLT01003	Intermediate (101B)	0.012	--	--	--	--	--	--
		69PLT01010	Effluent	ND	--	--	--	--	--	--
Carbon was exchanged in CF101B on 10 May 2011. Following replacement, CF101A was aligned as lead and CF101B as lag.										
June	25-May-11	69EW0001	Deep Well Influent	0.093	11.28	6.00	3.65	95	174.4	0.0
		69EW0002	69EW0002 Influent	0.031	11.58	6.36	1.83	93	148.4	0.0
		69PLT01002	Intermediate (101A)	0.013	11.31	6.04	3.92	94	208.3	0.0
		69PLT01010	Effluent	ND	11.32	5.96	3.10	95	193.4	0.6
Resample	3-Jun-11	69PLT01002	Intermediate (101A)	BRL						
July	27-Jun-11	69EW0001	Deep Well Influent	0.125	--	--	--	--	--	--
		69EW0002	69EW0002 Influent	0.014	--	--	--	--	--	--
		69PLT01002	Intermediate (101A)	0.016	--	--	--	--	--	--
		69PLT01010	Effluent	ND	--	--	--	--	--	--
Carbon was exchanged in CF101A on July 18, 2011. Following replacement, CF101B was aligned as lead and CF101A as lag.										
August	27-Jul-11	69EW0001	Deep Well Influent	0.084	--	--	--	--	--	--
		69EW0002	69EW0002 Influent	0.021	--	--	--	--	--	--
		69PLT01003	Intermediate (101B)	ND	--	--	--	--	--	--
		69PLT01010	Effluent	ND	--	--	--	--	--	--

Table 5
FS-28 Treatment Plant Sampling Results
FS-28 2011 Summary Letter Report

Month of Event	Sample Date	Loc ID	Sample Location	Laboratory Analyses	Water Quality Parameters					
				EDB (µg/L) MMCL = 0.02	Temp (°C)	pH (std)	DO (mg/L)	SpC (µS/cm)	ORP (mV)	Turbidity (NTU)
September	25-Aug-11	69EW0001	Deep Well Influent	0.091	--	--	--	--	--	--
		69EW0002	69EW0002 Influent	0.022	--	--	--	--	--	--
		69PLT01003	Intermediate (101B)	BRL	--	--	--	--	--	--
		69PLT01010	Effluent	ND	--	--	--	--	--	--
October	27-Sep-11	69EW0001	Deep Well Influent	0.09J	--	--	--	--	--	--
		69EW0002	69EW0002 Influent	0.020	--	--	--	--	--	--
		69PLT01003	Intermediate (101B)	0.015	--	--	--	--	--	--
		69PLT01010	Effluent	ND	--	--	--	--	--	--
Carbon was exchanged in CF101B on 19 October 2011. Following replacement, CF101A was aligned as lead and CF101B as lag.										
November	27-Oct-11	69EW0001	Deep Well Influent	0.094	--	--	--	--	--	--
		69EW0002	69EW0002 Influent	0.020	--	--	--	--	--	--
		69PLT01002	Intermediate (101A)	BRL	--	--	--	--	--	--
		69PLT01010	Effluent	ND	--	--	--	--	--	--
December	28-Nov-11	69EW0001	Deep Well Influent	0.068	11.52	5.95	3.59	91	189.9	0.0
		69EW0002	69EW0002 Influent	0.015	11.19	6.48	1.82	88	167.6	0.1
		69PLT01002	Intermediate (101A)	ND	NM ¹	NM ¹	NM ¹	NM ¹	NM ¹	NM ¹
		69PLT01010	Effluent	ND	11.49	6.01	2.28	91	199.1	0.0
January	27-Dec-11	69EW0001	Deep Well Influent	0.075	--	--	--	--	--	--
		69EW0002	69EW0002 Influent	0.018	--	--	--	--	--	--
		69PLT01002	Intermediate (101A)	0.017	--	--	--	--	--	--
		69PLT01010	Effluent	ND	--	--	--	--	--	--

Data Source: AFCEE, February 2012, MMR-AFCEE Data Warehouse

Notes:

Bold values represent EDB concentrations above the MMCL.

NM¹ = water quality parameter collection at the midpoint sample port was omitted.

Water quality parameters (pH, temperature, DO, SpC, turbidity, and ORP) were measured semiannually at influent, post-GAC at each active GAC vessel, and plant effluent sampling locations. The measurements are taken using a flow-through cell and the Yellow Springs Instrument (YSI).

-- = water quality parameters not collected.

Key:

BRL = below reporting limit

°C = degrees Celsius

DO = dissolved oxygen

EDB = ethylene dibromide

FS-28 = Fuel Spill-28

GAC = granular activated carbon

mg/L = milligrams per liter

MMCL = Massachusetts Maximum Contaminant Level

mV = millivolts

ND = not detected

NTU = nephelometric turbidity units

ORP = oxidation-reduction potential

SpC = specific conductance

Temp = temperature

µg/L = micrograms per liter

µS/cm = microsiemens per centimeter

Table 6
FS-28 Treatment System Flow Rates
FS-28 2011 Summary Letter Report

Week Ending	69EW0001 Flow Rate (gpm)	69EW0002 Flow Rate (gpm)	SWPs Flow Rate (gpm)	Treatment Plant Total Flow Rate (gpm)
5-Jan-11	543	75	N/A	618
12-Jan-11	549	75	N/A	624
19-Jan-11	426	59	N/A	483
26-Jan-11	549	75	N/A	624
2-Feb-11	550	75	N/A	626
9-Feb-11	550	75	N/A	625
16-Feb-11	545	75	N/A	620
23-Feb-11	550	75	N/A	625
2-Mar-11	550	73	N/A	623
9-Mar-11	545	68	N/A	613
16-Mar-11	516	71	N/A	587
23-Mar-11	544	75	N/A	619
30-Mar-11	549	75	N/A	624
6-Apr-11	549	75	N/A	623
13-Apr-11	547	75	N/A	621
20-Apr-11	550	75	N/A	625
27-Apr-11	550	75	N/A	625
4-May-11	550	75	N/A	625
11-May-11	467	64	N/A	531
18-May-11	544	27	N/A	571
25-May-11	547	75	N/A	622
1-Jun-11	550	75	N/A	625
8-Jun-11	548	75	N/A	623
15-Jun-11	529	75	N/A	604
22-Jun-11	541	74	N/A	615
29-Jun-11	545	75	N/A	620
6-Jul-11	544	75	N/A	619
13-Jul-11	544	75	N/A	619
20-Jul-11	458	60	N/A	518
27-Jul-11	324	43	N/A	366
3-Aug-11	537	70	N/A	607
10-Aug-11	495	75	N/A	570
17-Aug-11	531	71	N/A	603
24-Aug-11	532	75	N/A	608
31-Aug-11	262	31	N/A	293
7-Sep-11	529	75	N/A	604
14-Sep-11	528	75	N/A	603
21-Sep-11	525	75	N/A	600
28-Sep-11	523	73	N/A	596
5-Oct-11	520	75	N/A	595
12-Oct-11	515	75	N/A	590
19-Oct-11	468	68	N/A	535
26-Oct-11	460	68	N/A	528
2-Nov-11	538	75	N/A	613
9-Nov-11	534	75	N/A	609
16-Nov-11	531	75	N/A	606
23-Nov-11	527	75	N/A	602
30-Nov-11	522	75	N/A	597
7-Dec-11	516	75	N/A	591
14-Dec-11	468	68	N/A	542
21-Dec-11	513	74	N/A	587
28-Dec-11	512	75	N/A	586
Average Flow Rate (gpm)	518	71	N/A	589
Optimized Design Flow Rate (gpm) (2010 Scenario 01)	550	75	N/A	625
Percent of Optimized Design Rate	94	95	N/A	94

Data Source: AFCEE, February 2012, MMR-AFCEE Data Warehouse.

Notes:

1. Flow rates presented are weekly averages.
2. Downtimes due to routine and non-routine operations and maintenance activities were included in the calculation of the average flow rates.
3. 2010 Scenario 01 started on 07 October 2010 with an increase in flow at 69EW0002 from 50 to 75 gpm; 69EW0001 flow remained unchanged from 2009 Scenario 01 (550 gpm)

Key:

gpm = gallons per minute

N/A = not applicable

Table 7
FS-28 Treatment System Downtime Summary
FS-28 2011 Summary Letter Report

Date	Hours Off-Line	Reason
1/13/2011	23.75	Intentional for carbon exchange.
1/16/2011	16.87	69EW0002 tripped off due to a power failure/variable frequency drive fault.
1/18/2011	12.67	69EW0001 tripped due to a power failure.
2/25/2011	3.67	Power failure/wires down 69EW0002 off only.
3/9/2011	24.58	Intentional for carbon exchange.
5/10/2011	24.28	Intentional for carbon exchange.
5/13/2011	54.58	69EW0002 off due to a power failure.
5/18/2011	4.97	69EW0002 off due to a power failure.
6/5/2011	25.58	69EW0002 tripped off, reset at well and restarted.
6/9/2011	11.20	69EW0001 tripped off due to a power failure during the thunderstorms.
7/18/2011	24.50	Intentional for carbon exchange.
7/22/2011	65.50	Plant intentionally shut down for an energy curtailment event.
8/2/2011	10.88	69EW0002 tripped off due to a power failure during the thunderstorms.
8/15/2011	8.60	69EW0002 tripped off due to a power failure.
8/26/2011	96.83	Plant shut down as precaution for potential hurricane.
9/28/2011	5.33	69EW0002 tripped off due to a power failure.
10/19/2011	24.67	Intentional for carbon exchange.
10/21/2011	102.50	Cranberry farmer flooding lower bogs/69EW0001 at reduced flow due to back pressure.
12/9/2011	2.17	69EW0001 off, power failure.
12/12/2011	13.67	Plant intentionally shut down for energy curtailment event.
12/19/2011	2.50	Plant intentionally shut down for energy curtailment event.

Table 8
FS-28 Treatment System Mass Removal Summary
FS-28 2011 Summary Letter Report

Date	69EW0001 (Extraction Well Influent)		69EW0002 (Extraction Well Influent)		69PLT01023 (SWP Influent)		Total EDB Removed	
	Incremental Mass Removed (lbs)	Cumulative Mass Removed (lbs)	Incremental Mass Removed (lbs)	Cumulative Mass Removed (lbs)	Incremental Mass Removed (lbs)	Cumulative Mass Removed (lbs)	Incremental Mass Removed (lbs)	Cumulative Mass Removed (lbs)
Jan-11	0.028	12.360	0.0012	0.036	0.000	2.068	0.029	14.464
Feb-11	0.024	12.380	0.0012	0.038	0.000	2.068	0.026	14.486
Mar-11	0.024	12.410	0.0012	0.039	0.000	2.068	0.026	14.517
Apr-11	0.023	12.430	0.0009	0.040	0.000	2.068	0.024	14.538
May-11	0.020	12.450	0.0007	0.040	0.000	2.068	0.021	14.558
Jun-11	0.022	12.470	0.0009	0.041	0.000	2.068	0.023	14.579
Jul-11	0.018	12.490	0.0006	0.042	0.000	2.068	0.018	14.600
Aug-11	0.015	12.510	0.0005	0.042	0.000	2.068	0.016	14.620
Sep-11	0.017	12.520	0.0006	0.043	0.000	2.068	0.018	14.631
Oct-11	0.017	12.540	0.0005	0.043	0.000	2.068	0.018	14.651
Nov-11	0.015	12.560	0.0005	0.044	0.000	2.068	0.015	14.672
Dec-11	0.013	12.570	0.0004	0.044	0.000	2.068	0.013	14.682
EDB removed (lbs) by extraction well 69EW0001 during reporting period (January 2011 - December 2011)								0.237
EDB removed (lbs) by extraction well 69EW0002 during reporting period (January 2011 - December 2011)								0.009
Total EDB removed (lbs) during reporting period (January 2011 - December 2011)								0.246
Total EDB removed (lbs) since system startup (October 1997 - December 2011)								14.682

Data Source: AFCEE, February 2012, MMR-AFCEE Data Warehouse

Notes:

69EW0001 started operating in October 1997.

SWPs started operating in April 1999 and ceased operation in November 2008.

69EW0002 started operating in December 2007.

Key:

EDB = ethylene dibromide

FS-28 = Fuel Spill-28

lbs = pounds

SWPs = shallow wellpoints

Table 9
FS-28 Remedial System Electrical Consumption and Associated Air Emissions
FS-28 2011 Summary Letter Report

		1/1/2011 to 12/31/2011	System Startup (11/1997) to 12/31/2011
Volume of Groundwater Treated (million gallons)		310	4,919
Groundwater COC Mass Removal (pounds)		0.246	14.682
Electrical Usage (MWh)		413	7,232
Estimated Air Emissions ¹ (based on electrical usage)	CO ₂ (tons)	271	5,876
	NO _x (lbs)	582	9,274
	PM-10 (lbs)	33	351
	SO ₂ (lbs)	1,553	11,037
	VOCs (lbs)	20	432
Estimated Reduction in Air Emissions due to Green Power Purchases ²	CO ₂ (tons)	135	513
	NO _x (lbs)	291	1,000
	PM-10 (lbs)	17	51
	SO ₂ (lbs)	776	2,226
	VOCs (lbs)	10	38
Estimated Reduction in Air Emissions due to MMR Wind Turbine Operation ³	CO ₂ (tons)	128	171
	NO _x (lbs)	275	368
	PM-10 (lbs)	15.7	21.1
	SO ₂ (lbs)	732	982
	VOCs (lbs)	9.6	12.9
Estimated Total Air Emissions with consideration of Green Power Purchases and MMR Wind Turbine Operation	CO ₂ (tons)	8	5,192
	NO _x (lbs)	17	7,905
	PM-10 (lbs)	1.0	279
	SO ₂ (lbs)	44	7,828
	VOCs (lbs)	0.6	381

Notes:

1) The estimated air emissions presented in this table are based on the assumption that until 4/30/2009, the power used to operate the MMR remedial systems was provided by the Mirant Canal Station power plant in Sandwich, MA. This power plant primarily produced electricity generated by the combustion of fuel oil and has been off-line since 5/1/2009. Starting on 5/1/2009, air emissions are based on electricity generated by the average mix of power sources in Massachusetts. Air emissions were calculated using MMR utility data from AFCEE's Metrix 4 Utility Accounting Software (<http://www.abraxasenergy.com/metrix4.php>) and emission factors obtained from the following websites:
<http://www.csgnetwork.com/elecpowerpolcalc.html>
<http://www.metrixcentral.com/EmissionsCalculator/Emissions%20Factors%202004.pdf>

2) Emissions offset by purchases of electricity from renewable sources beginning 7/1/2008.

3) Emissions offset by operation of AFCEE-owned wind turbines beginning on 12/2/2009 (Wind I) and 11/1/2011 (Wind II).

Key:

COC = contaminant of concern

CO₂ = carbon dioxide

FS-28 = Fuel Spill-28

lbs = pounds

MMR = Massachusetts Military Reservation

MWh = megawatt hours

NO_x = nitrogen oxides

PM-10 = particulate matter with a diameter of 10 micrometers or less

SO₂ = sulfur dioxide

VOCs = volatile organic compounds

ATTACHMENT A

**Comparison of Detected Concentrations in FS-28 Groundwater,
Surface Water, and Treatment Plant Samples to Applicable
Groundwater and Surface Water Standards**

Attachment A
Comparison of Detected Concentrations in FS-28 Groundwater, Surface Water, and Treatment Plant Samples
to Applicable Groundwater and Surface Water Standards
FS-28 2011 Summary Letter Report

Location Identification	Sample Date	Sample Elevation (ft msl)	Matrix	Test	Analyte	Result	DL	RL	Standard	Type ¹	Standard Exceeded?
						All units = µg/L					
69EW0001	1/25/2011	-159.39	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.151	0.005	0.01	0.02	MMCL	Yes
69EW0001	2/25/2011	-159.39	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.124	0.005	0.01	0.02	MMCL	Yes
69EW0001	3/25/2011	-159.39	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.121	0.005	0.01	0.02	MMCL	Yes
69EW0001	4/25/2011	-159.39	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.117	0.005	0.01	0.02	MMCL	Yes
69EW0001	5/25/2011	-159.39	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.093	0.005	0.01	0.02	MMCL	Yes
69EW0001	6/27/2011	-159.39	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.125	0.005	0.01	0.02	MMCL	Yes
69EW0001	7/27/2011	-159.39	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.084	0.005	0.01	0.02	MMCL	Yes
69EW0001	8/25/2011	-159.39	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.091	0.005	0.01	0.02	MMCL	Yes
69EW0001	9/27/2011	-159.39	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.09 J	0.005	0.01	0.02	MMCL	Yes
69EW0001	10/27/2011	-159.39	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.094	0.005	0.01	0.02	MMCL	Yes
69EW0001	11/28/2011	-159.39	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.068	0.005	0.01	0.02	MMCL	Yes
69EW0001	12/27/2011	-159.39	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.075	0.005	0.01	0.02	MMCL	Yes
69EW0002	1/25/2011	-140.10	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.047	0.005	0.01	0.02	MMCL	Yes
69EW0002	2/25/2011	-140.10	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.049	0.005	0.01	0.02	MMCL	Yes
69EW0002	3/25/2011	-140.10	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.041	0.005	0.01	0.02	MMCL	Yes
69EW0002	4/25/2011	-140.10	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.030	0.005	0.01	0.02	MMCL	Yes
69EW0002	5/25/2011	-140.10	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.031	0.005	0.01	0.02	MMCL	Yes
69EW0002	6/27/2011	-140.10	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.014	0.005	0.01	0.02	MMCL	No
69EW0002	7/27/2011	-140.10	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.021	0.005	0.01	0.02	MMCL	Yes
69EW0002	8/25/2011	-140.10	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.022	0.005	0.01	0.02	MMCL	Yes
69EW0002	9/27/2011	-140.10	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.020	0.005	0.01	0.02	MMCL	No
69EW0002	10/27/2011	-140.10	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.020	0.005	0.01	0.02	MMCL	No
69EW0002	11/28/2011	-140.10	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.015	0.005	0.01	0.02	MMCL	No
69EW0002	12/27/2011	-140.10	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.018	0.005	0.01	0.02	MMCL	No
69MW0028A	2/18/2011	-69.49	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.011	0.005	0.01	0.02	MMCL	No
69MW0029B	2/18/2011	-92.35	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.014	0.005	0.01	0.02	MMCL	No
69MW0030A	2/18/2011	-88.77	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.017	0.005	0.01	0.02	MMCL	No
69MW0030A	8/15/2011	-88.77	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.012 J	0.005	0.01	0.02	MMCL	No
69MW0034A	2/18/2011	-114.40	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.039	0.005	0.01	0.02	MMCL	Yes
69MW1283A	2/17/2011	-137.00	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.4	0.024	0.048	0.02	MMCL	Yes
69MW1283B	2/17/2011	-186.10	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	1.1	0.048	0.096	0.02	MMCL	Yes
69MW1284A	2/17/2011	-180.00	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.472	0.024	0.048	0.02	MMCL	Yes
69MW1284B	2/22/2011	-215.90	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.9	0.049	0.098	0.02	MMCL	Yes
69MW1304	2/17/2011	-181.00	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.811	0.048	0.095	0.02	MMCL	Yes
69MW1306A	2/22/2011	-81.74	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.026	0.005	0.01	0.02	MMCL	Yes
69MW1306C	3/14/2011	-117.77	WG	E504.2	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.021	0.005	0.01	0.02	MMCL	Yes
69MW1310	2/17/2011	-202.20	WG	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.104	0.005	0.01	0.02	MMCL	Yes
69PLT01002 (MID)	1/25/2011	N/A	WW	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	BRL	0.005	0.01	0.02	MMCL	No
69PLT01002 (MID)	2/25/2011	N/A	WW	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.017	0.005	0.01	0.02	MMCL	No
69PLT01002 (MID)	5/25/2011	N/A	WW	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.013	0.005	0.01	0.02	MMCL	No
69PLT01002 (MID)	6/3/2011	N/A	WW	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	BRL	0.005	0.01	0.02	MMCL	No
69PLT01002 (MID)	6/27/2011	N/A	WW	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.016	0.005	0.01	0.02	MMCL	No

Attachment A
Comparison of Detected Concentrations in FS-28 Groundwater, Surface Water, and Treatment Plant Samples
to Applicable Groundwater and Surface Water Standards
FS-28 2011 Summary Letter Report

Location Identification	Sample Date	Sample Elevation (ft msl)	Matrix	Test	Analyte	Result	DL	RL	Standard	Type ¹	Standard Exceeded?
						All units = µg/L					
69PLT01002 (MID)	10/27/2011	N/A	WW	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	BRL	0.005	0.01	0.02	MMCL	No
69PLT01002 (MID)	12/27/2011	N/A	WW	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.017	0.005	0.01	0.02	MMCL	No
69PLT01003 (MID)	3/25/2011	N/A	WW	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	BRL	0.005	0.01	0.02	MMCL	No
69PLT01003 (MID)	4/25/2011	N/A	WW	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.012	0.005	0.01	0.02	MMCL	No
69PLT01003 (MID)	8/25/2011	N/A	WW	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	BRL	0.005	0.01	0.02	MMCL	No
69PLT01003 (MID)	9/27/2011	N/A	WW	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.015	0.005	0.01	0.02	MMCL	No
69SW2007	6/7/2011	N/A	WS	E504.1	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	BRL	0.005	0.01	7.71 ⁽²⁾ /31 ⁽³⁾	RBC/ECO	No

Data Source: AFCEE, February 2012, MMR-AFCEE Data Warehouse

Notes:

1. MMCL from Massachusetts Department of Environmental Protection (MassDEP) web page, <http://www.mass.gov/dep/water/dwstand.pdf>.
2. EDB screening-level risk based concentration for imminent human health risk (10^3 risk) = 7.71 µg/L: Preliminary Screening-Level Human Health Risk Evaluation for Exposure to FS-28 Surface Water; Appendix D of *Final Fuel Spill-28 2002 Annual System Performance and Ecological Impact Monitoring Report*, dated March 2003.
3. EDB screening-level ecological benchmark for surface water: *Final Ethylene Dibromide Derivation of Aquatic Screening Benchmarks*, dated November 1998.

Key:

BRL = below reporting limit

DL = detection limit

ECO = screening level ecological benchmark

EDB = ethylene dibromide

FS-28 = Fuel Spill-28

ft = feet

J = estimated concentration

MID = treatment plant midpoint sample

msl = mean sea level

MMCL = Massachusetts Maximum Contaminant Level

N/A = information not applicable

RBC = screening level risk-based concentration

RL = reporting limit

WG = groundwater sample

WS = surface water sample

WW = plant water

µg/L = micrograms per liter

ATTACHMENT B
FS-28 2011 SLR
Data Summary Report

Attachment B
Data Summary Report
Fuel Spill-28 2011 Summary Letter Report

INTRODUCTION

The objective of this data summary report (DSR) is to assess the data quality of analytical results for samples collected for the Fuel Spill-28 System Performance and Ecological Impact Monitoring (SPEIM) Program at the Massachusetts Military Reservation (MMR) as presented in the *Fuel Spill-28 2011 Summary Letter Report*. This report is intended as a general data quality assessment designed to summarize data issues.

ANALYTICAL DATA

This DSR covers 73 groundwater samples with four field duplicate samples, 22 surfacewater samples with two field duplicate samples, and 25 plant samples. Field duplicates are not required for treatment facility plant samples. These samples were reported under 27 sample delivery groups. Samples were collected between 21 January 2011 and 27 December 2011. The analyses were performed by Analytics Environmental Laboratory LLC (ANAP) in Portsmouth, New Hampshire. Samples were collected and shipped by overnight carrier or delivered by courier to ANAP. Samples were analyzed for the analyte/method provided in Table B-1.

Table B-1
Analytical Parameter

Parameter	Method	Laboratory
Ethylene Dibromide (EDB)	E504.1	ANAP

E = Environmental Protection Agency (EPA) Method

The data were assessed using the MMR SPEIM Quality Assurance Project Plan (QAPP)¹. The assessment included a review of the following:

¹ AFCEE. 2011 (August). *AFCEE MMR SPEIM/LTM/O&M Program Quality Assurance Project Plan*. 404929-Program-Multiple-QAPP-001. Prepared by CH2M HILL for AFCEE/MMR, Installation Restoration Program, Otis ANG Base, MA.

- Chain-of-Custody documentation
- Holding time compliance
- Required quality control (QC) samples at the specified frequencies
- Method blanks
- Laboratory control spiking samples
- Surrogate spike recoveries
- Initial and continuing calibration information and other method-specific criteria as defined by the SPEIM QAPP

Field samples were reviewed to ascertain field compliance and data quality issues. This included a review of equipment blanks, and field duplicates.

Data were carried through data validation as described in the SPEIM QAPP and data flags were assigned according to the SPEIM QAPP. These flags, and the reason for each flag, were entered into the electronic database and can be found in Table B-2 (located at the end of this attachment). Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there is only one final flag. A final flag is applied to the data, and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample impacts.

The data flags are listed in the SPEIM QAPP and are defined as follows:

- J = Analyte was present but the reported value may not be accurate or precise (estimated).
- R = Analyte result was unusable due to deficiencies in the ability to analyze the sample and meet QC criteria.
- U = Analyte was not detected at the specified detection limit.
- UJ = Analyte was not detected and the specified detection limit may not be accurate or precise (estimated).

FINDINGS

The summaries of the data validation findings are contained in the following subsections and Table B-2.

Holding Times

All holding-time criteria were met.

Calibration

Initial and continuing calibrations were analyzed as required in every analytical batch and were in control. No calibration flags were applied.

Method Blanks

Method blanks were analyzed at the required frequency for the method. No method blank flags were applied.

Field Blanks

Equipment blanks were collected and analyzed at the required frequency. No field blank flags were applied.

Field Duplicates

Field duplicates were collected as required, and precision was acceptable. No field duplicate flags were applied.

Matrix Spike Samples

As presented in the SPEIM QAPP Table 3-4, matrix spikes and matrix spike duplicates were not required to be collected for routine long-term monitoring samples. No non-routine samples were collected during this time period.

Surrogates

Surrogate recoveries met the method SPEIM QAPP criteria overall. Twenty-four samples had surrogate recoveries less than the lower control limit for method E504.1. Two detected results and 22 nondetected results were qualified as estimated values and flagged “J” and “UJ”.

Laboratory Control Samples

Laboratory control sample/laboratory control sample duplicates (LCS/LCSD) were analyzed as required and were in control. No LCS/LCSD flags were applied.

Confirmation Results

Confirmation samples were analyzed as required by method E504.1. No confirmation flags were applied.

Chain of Custody

No chain of custody anomalies were noted in the review.

Overall Assessment

The goal of this assessment is to demonstrate that a sufficient number of representative samples were collected and the resulting analytical data can be used to support the decision-making process. The procedures for assessing the precision, accuracy, representativeness, completeness, and comparability parameters (PARCC) are addressed in the SPEIM QAPP. The following summary highlights the PARCC findings for the above-defined events:

1. The completeness goal for valid usable data is 95 percent for aqueous samples and completeness for EDB samples was 100 percent. The routinely acceptable performance of field and laboratory QC indicators (field duplicates, field blanks, laboratory blanks, MS/MSDs, surrogate spikes, LCS, and calibrations) shows that the precision and accuracy of the data generally met project objectives.
3. Sample results are representative and comparable to field conditions and past historical data because the field sampling and laboratory analyses were performed using standardized and documented procedures as defined in project documents. In addition, all results were reported with industry standard units.

Table B-2
Validation Flags^a

Field ID	Method	Analyte	Final Result	Units	Final Flag	Reason
CHPK00017A-S0811DIF	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPK00029A-S0811DIF	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPK00029B-S0811DIF	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPK00030A-S0811DIF	E504.1	1,2-Dibromoethane (EDB)	0.012	µg/L	J	Sur<LCL
CHPK00031A-S0811DIF	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPK00032A-S0811DIF	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPK00032B-S0811DIF	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPK0020A-A0111DIF	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPK0032B-A0111DIF	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPK10029B-S0811DIF	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPL00006-M0811	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPL00010-M0811	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPL00019-M0811	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPL00046-M0811	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPL00048-M0811	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPL00049-M0811	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPL00060-M0811	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPL00527-M0811	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPL02001-M0811	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPL02002-M0611	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPL02002-M0811	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPL02007-M0811	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHPL10527-M0811	E504.1	1,2-Dibromoethane (EDB)	0.005	µg/L	UJ	Sur<LCL
CHTC00001-M1011	E504.1	1,2-Dibromoethane (EDB)	0.09	µg/L	J	Sur<LCL

Notes:

^aField samples and field duplicates only.

Table sorted by Reason, Analyte and Field ID.

Key:

J = estimated value

Sur < LCL = Surrogate recovery less than lower limit

UJ =estimated nondetect

µg/L = micrograms per liter

Attachment B
Analytical Laboratory Results, January - December 2011
Fuel Spill-28 2011 Summary Letter Report

Location	Date	Sample ID	Depth	Type	Matrix	Test	Prep	Analyte	Result	DL	RL	Units	Qual
69EW0001	1/25/2011	CHTC00001-M0211	190	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.151	0.005	0.01	µg/L	
69EW0001	2/25/2011	CHTC00001-M0311	190	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.124	0.005	0.01	µg/L	
69EW0001	3/25/2011	CHTC00001-M0411	190	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.121	0.005	0.01	µg/L	
69EW0001	4/25/2011	CHTC00001-M0511	190	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.117	0.005	0.01	µg/L	
69EW0001	5/25/2011	CHTC00001-M0611	190	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.093	0.005	0.01	µg/L	
69EW0001	6/27/2011	CHTC00001-M0711	190	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.125	0.005	0.01	µg/L	
69EW0001	7/27/2011	CHTC00001-M0811	190	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.084	0.005	0.01	µg/L	
69EW0001	8/25/2011	CHTC00001-M0911	190	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.091	0.005	0.01	µg/L	
69EW0001	9/27/2011	CHTC00001-M1011	190	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.09	0.005	0.01	µg/L	J
69EW0001	10/27/2011	CHTC00001-M1111	190	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.094	0.005	0.01	µg/L	
69EW0001	11/28/2011	CHTC00001-M1211	190	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.068	0.005	0.01	µg/L	
69EW0001	12/27/2011	CHTC00001-M0112	190	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.075	0.005	0.01	µg/L	
69EW0002	1/25/2011	CHTC00002-M0211	192	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.047	0.005	0.01	µg/L	
69EW0002	2/25/2011	CHTC00002-M0311	192	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.049	0.005	0.011	µg/L	
69EW0002	3/25/2011	CHTC00002-M0411	192	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.041	0.005	0.01	µg/L	
69EW0002	4/25/2011	CHTC00002-M0511	192	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.03	0.005	0.01	µg/L	
69EW0002	5/25/2011	CHTC00002-M0611	192	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.031	0.005	0.01	µg/L	
69EW0002	6/27/2011	CHTC00002-M0711	192	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.014	0.005	0.01	µg/L	
69EW0002	7/27/2011	CHTC00002-M0811	192	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.021	0.005	0.01	µg/L	
69EW0002	8/25/2011	CHTC00002-M0911	192	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.022	0.005	0.01	µg/L	
69EW0002	9/27/2011	CHTC00002-M1011	192	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.02	0.005	0.01	µg/L	
69EW0002	10/27/2011	CHTC00002-M1111	192	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.02	0.005	0.01	µg/L	
69EW0002	11/28/2011	CHTC00002-M1211	192	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.015	0.005	0.01	µg/L	
69EW0002	12/27/2011	CHTC00002-M0112	192	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.018	0.005	0.01	µg/L	
69MW0028A	2/18/2011	CHPK0028A-A0111DIF	97	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.011	0.005	0.01	µg/L	
69MW0029A	2/18/2011	CHPK0029A-A0111DIF	168	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW0029A	8/15/2011	CHPK00029A-S0811DIF	168	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69MW0029B	2/18/2011	CHPK0029B-A0111DIF	132	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.014	0.005	0.01	µg/L	
69MW0029B	8/15/2011	CHPK10029B-S0811DIF	132	FD1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69MW0029B	8/15/2011	CHPK00029B-S0811DIF	132	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69MW0030A	2/18/2011	CHPK0030A-A0111DIF	128	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.017	0.005	0.01	µg/L	
69MW0030A	8/15/2011	CHPK00030A-S0811DIF	128	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.012	0.005	0.01	µg/L	J
69MW0031A	2/18/2011	CHPK0031A-A0111DIF	157	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW0031A	8/15/2011	CHPK00031A-S0811DIF	157	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69MW0032A	2/18/2011	CHPK0032A-A0111DIF	175	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW0032A	8/15/2011	CHPK00032A-S0811DIF	175	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69MW0032B	2/18/2011	CHPK0032B-A0111DIF	142	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69MW0032B	8/15/2011	CHPK00032B-S0811DIF	142	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69MW0033A	2/18/2011	CHPK0033A-A0111DIF	22	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW0034A	2/18/2011	CHPK0034A-A0111DIF	143	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.039	0.005	0.01	µg/L	
69MW1279C	10/11/2011	CHPM0079C-A1011DIF	153	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW1283A	2/17/2011	CHPK1083A-A0111DIF	173	FD1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.373	0.027	0.05	µg/L	
69MW1283A	2/17/2011	CHPK0083A-A0111DIF	173	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.4	0.024	0.05	µg/L	
69MW1283B	2/17/2011	CHPK0083B-A0111DIF	223	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	1.1	0.048	0.10	µg/L	
69MW1284A	2/17/2011	CHPK0084A-A0111DIF	212	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.472	0.024	0.05	µg/L	

Attachment B
Analytical Laboratory Results, January - December 2011
Fuel Spill-28 2011 Summary Letter Report

Location	Date	Sample ID	Depth	Type	Matrix	Test	Prep	Analyte	Result	DL	RL	Units	Qual
69MW1284B	2/22/2011	CHPK0084B-A0111DIF	248	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.9	0.049	0.10	µg/L	
69MW1285A	2/22/2011	CHPK0085A-A0111DIF	63	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW1285B	2/22/2011	CHPK0085B-A0111DIF	183	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW1286	2/22/2011	CHPK00086-A0111DIF	183	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW1286A	2/22/2011	CHPK0086A-A0111DIF	130	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW1303A	2/22/2011	CHPK0003A-A0111DIF	206	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW1303B	2/22/2011	CHPK0003B-A0111DIF	246	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW1304	2/17/2011	CHPK00004-A0111DIF	216	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.811	0.048	0.10	µg/L	
69MW1306A	2/22/2011	CHPK0006A-A0111DIF	108	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.026	0.005	0.01	µg/L	
69MW1306C	3/14/2011	CHPK0006C-A0111DIF	144	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.021	0.005	0.01	µg/L	
69MW1310	2/17/2011	CHPK00010-A0111DIF	235	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.104	0.005	0.01	µg/L	
69MW1315	3/14/2011	CHPK00015-A0111DIF	236	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW1317A	2/17/2011	CHPK0317A-A0111DIF	173	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW1317B	2/17/2011	CHPK0317B-A0111DIF	141	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW1317C	2/17/2011	CHPK0317C-A0111DIF	90	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW1318A	2/22/2011	CHPK0318A-A0111DIF	158	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69MW1501	1/21/2011	CHPK01501-O0111	91	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PLT01002	1/25/2011	CHTC01002-M0211	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	BRL	0.005	0.01	µg/L	J
69PLT01002	2/25/2011	CHTC01002-M0311	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.017	0.005	0.01	µg/L	
69PLT01002	5/25/2011	CHTC01002-M0611	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.013	0.005	0.01	µg/L	
69PLT01002	6/3/2011	CHTC01002-R0611	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	BRL	0.005	0.01	µg/L	J
69PLT01002	6/27/2011	CHTC01002-M0711	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.016	0.005	0.01	µg/L	
69PLT01002	10/27/2011	CHTC01002-M1111	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	BRL	0.005	0.01	µg/L	J
69PLT01002	11/28/2011	CHTC01002-M1211	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PLT01002	12/27/2011	CHTC01002-M0112	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	BRL	0.005	0.01	µg/L	J
69PLT01003	3/25/2011	CHTC01003-M0411	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	BRL	0.005	0.01	µg/L	J
69PLT01003	4/25/2011	CHTC01003-M0511	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.012	0.005	0.01	µg/L	
69PLT01003	7/27/2011	CHTC01003-M0811	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PLT01003	8/25/2011	CHTC01003-M0911	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	BRL	0.005	0.01	µg/L	J
69PLT01003	9/27/2011	CHTC01003-M1011	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.015	0.005	0.01	µg/L	
69PLT01010	1/25/2011	CHTC01010-M0211	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PLT01010	2/25/2011	CHTC01010-M0311	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PLT01010	3/25/2011	CHTC01010-M0411	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PLT01010	4/25/2011	CHTC01010-M0511	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PLT01010	5/25/2011	CHTC01010-M0611	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PLT01010	6/27/2011	CHTC01010-M0711	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PLT01010	7/27/2011	CHTC01010-M0811	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PLT01010	8/25/2011	CHTC01010-M0911	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PLT01010	9/27/2011	CHTC01010-M1011	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PLT01010	10/27/2011	CHTC01010-M1111	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PLT01010	11/28/2011	CHTC01010-M1211	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PLT01010	12/27/2011	CHTC01010-M0112	N/A	N1	WW	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PZ0005B	3/14/2011	CHPK0005B-A0111DIF	42	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PZ0017A	2/18/2011	CHPK0017A-A0111DIF	180	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PZ0017A	8/15/2011	CHPK00017A-S0811DIF	180	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ

Attachment B
Analytical Laboratory Results, January - December 2011
Fuel Spill-28 2011 Summary Letter Report

Location	Date	Sample ID	Depth	Type	Matrix	Test	Prep	Analyte	Result	DL	RL	Units	Qual
69PZ0019B	2/23/2011	CHPK0019B-A0111DIF	40	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PZ0020A	2/23/2011	CHPK0020A-A0111DIF	179	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69PZ0021A	2/23/2011	CHPK0021A-A0111DIF	159	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PZ0023A	3/14/2011	CHPK0023A-A0111DIF	173	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69PZ1286B	3/14/2011	CHPK0086B-A0111DIF	98	N1	WG	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69SW0006	6/7/2011	CHPL00006-M0611	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69SW0006	8/11/2011	CHPL00006-M0811	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69SW0010	6/7/2011	CHPL00010-M0611	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69SW0010	8/11/2011	CHPL00010-M0811	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69SW0019	6/7/2011	CHPL00019-M0611	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69SW0019	8/11/2011	CHPL00019-M0811	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69SW0046	6/7/2011	CHPL00046-M0611	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69SW0046	8/11/2011	CHPL00046-M0811	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69SW0048	6/7/2011	CHPL00048-M0611	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69SW0048	8/11/2011	CHPL00048-M0811	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69SW0049	6/7/2011	CHPL00049-M0611	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69SW0049	8/11/2011	CHPL00049-M0811	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69SW0060	6/7/2011	CHPL00060-M0611	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69SW0060	8/11/2011	CHPL00060-M0811	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69SW0527	6/7/2011	CHPL10527-M0611	N/A	FD1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69SW0527	6/7/2011	CHPL00527-M0611	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69SW0527	8/11/2011	CHPL10527-M0811	N/A	FD1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69SW0527	8/11/2011	CHPL00527-M0811	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69SW2001	6/7/2011	CHPL02001-M0611	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69SW2001	8/11/2011	CHPL02001-M0811	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69SW2002	6/7/2011	CHPL02002-M0611	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	U
69SW2002	8/11/2011	CHPL02002-M0811	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ
69SW2007	6/7/2011	CHPL02007-M0611	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	BRL	0.005	0.01	µg/L	J
69SW2007	8/11/2011	CHPL02007-M0811	N/A	N1	WS	E504.1	METHOD	1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	ND	0.005	0.01	µg/L	UJ

Data Source: AFCEE, February 2012, MMR-AFCEE Data Warehouse


Key:


BRL = below reporting limit	RL = reporting limit
DL = detection limit	U = undetected
FD1 = field duplicate	UJ = estimated non-detection
J = estimated value	WG = groundwater
N/A = not applicable	WS = surface water
ND = not detected	WW = wastewater
N1 = native sample	µg/L = micrograms per liter

ATTACHMENT C

FS-28 Project Note


Fuel Spill-28 2011 Annual SPEIM Data Presentation
[420005-SPEIM-FS28-PRJNOT-001](#)

 AFCEE SPEIM/LTM/O&M Otis ANG Base, Massachusetts AFCEE 4P08 FA8903-08-D8769-300	PROJECT NOTE		TASK ORDER 0300
			PROJECT NO. 420005
	DOCUMENT CONTROL NUMBER: 420005-SPEIM-FS28-PRJNOT-001	PAGE 1 OF 5	
		CDRL B008	


Confirmation Of: <input checked="" type="checkbox"/> Meeting <input type="checkbox"/> Change Notice <input type="checkbox"/> General Project Note	Date Held: 11 May 2011 Location: Large IRP Conference Room Date Issued: 27 March 2012 Recorded By: Nigel Tindall
Subject: FUEL SPILL-28 2011 ANNUAL SPEIM DATA PRESENTATION EPA #19 OU 09B SWOU-FS28/FS29 PLUMES	Issued By: Patricia de Groot  CH2M HILL PROGRAM MANAGER

ITEM	REMARKS
1.0	INTRODUCTION This project note summarizes the Fuel Spill-28 (FS-28) plume data presentation which included data collected for the FS-28 System Performance and Ecological Impact Monitoring (SPEIM) program. Data presented included the results of an annual groundwater sampling event (January 2011 to March 2011), and monthly treatment plant sampling (January through December 2010). In addition to the sampling of the monitoring wells in the SPEIM network, wells 69MW1501, 69PZ0020A, and 69PZ0021A were sampled during this annual sampling event to provide supplemental monitoring data to support plume characterization. These data were presented to the regulatory agencies during the 11 May 2011 Technical Update meeting. The handout for the presentation, including text slides and five figures, is included as Attachment A.
2.0	BACKGROUND The FS-28 plume is defined as the extent of groundwater containing the contaminant of concern (COC) ethylene dibromide (EDB) at concentrations exceeding the Massachusetts Maximum Contaminant Level (MMCL) of 0.02 micrograms per liter (µg/L). The FS-28 EDB plume is being remediated through the operation of the FS-28 extraction, treatment, and discharge (ETD) system. At the time of this data presentation (May 2011), the ETD system was extracting groundwater using two extraction wells at a combined flow rate of 625 gallons per minute (gpm). The flows to the treatment plant are as follows: (1) extraction well 69EW0001 operates at a flow rate of 550 gpm; and (2) extraction well 69EW0002 operates at a flow rate of 75 gpm; the locations of these two extraction wells are shown on Figure 1 in Attachment A. This optimized operational condition at FS-28 is referred to as 2010 Scenario 01 (AFCEE 2011). The third component of the FS-28 remedial system was a shallow wellpoint (SWP) system which was located to the south of 69EW0001. This SWP system was shutdown on a permanent basis in February 2010 because it was determined that although the SWP system had been successful in remediating the FS-28 plume in this area, it was no longer effective in remediating the remaining residual EDB contamination near the SWPs. Decommissioning activities associated with the SWP system were completed in February 2011 (AFCEE 2011). Monitoring the natural attenuation of this area of residual EDB contamination is part of the ongoing SPEIM program at FS-28.


Distribution: AFCEE: Jon Davis, Rose Forbes, Bob Power, Admin. Record; EPA: Bob Lim; MassDEP: Len Pinaud, Elliott Jacobs; CH2M HILL: Pat de Groot, Nigel Tindall, Doc. Control

 AFCEE SPEIM/LTM/O&M Otis ANG Base, Massachusetts AFCEE 4P08 FA8903-08-D8769-300	PROJECT NOTE		TASK ORDER 0300
			PROJECT NO. 420005
	DOCUMENT CONTROL NUMBER: 420005-SPEIM-FS28-PRJNOT-001 CDRL B008		PAGE 2 OF 5


ITEM	REMARKS
3.0	<p>RESULTS</p> <p>During the data presentation analytical results and concentration trend graphs were presented for select wells that are monitored throughout the FS-28 plume (Attachment A). Monitoring results were presented for: (i) the main EDB plume located upgradient (i.e., north) of 69EW0001; (ii) the deep leading edge lobe of the FS-28 EDB plume; (iii) the former shallow leading edge lobe; and (iv) the area of residual EDB contamination near the SWP system. Based on an evaluation of the monitoring data, the main findings are:</p> <p><u>Main EDB Plume</u></p> <ul style="list-style-type: none"> • EDB concentrations at five of the seven key indicator wells (69MW1283A/B, 69MW1284A/B, and 69MW1304) continue to show long-term declining trends in the core of the main EDB plume. • EDB concentrations at the two remaining key indicator wells located near the plume boundary (69MW1310 and 69MW1315) are fluctuating above and below the MMCL. • No EDB detections at 69MW1303A,B and 69MW1317A,B,C continue to support the conclusion that the main body of the FS-28 plume is being captured by 69EW0001. <p><u>Residual EDB Concentrations Near SWP System</u></p> <ul style="list-style-type: none"> • No EDB detections at wells screened shallow in the aquifer near former SWP system. • EDB concentrations remain above the MMCL at 69MW0034A, which is screened deeper in the aquifer, but concentrations are declining. • Monitoring data continue to support the decision to shutdown and decommission the SWP system. <p><u>Deep Leading Edge Lobe</u></p> <ul style="list-style-type: none"> • The highest EDB concentrations in the deep leading edge lobe have historically been reported at 69MW1318A; the EDB concentration trend at this well has shown a steady decline from 3.7 µg/L in December 2003 to 0.303 µg/L in September 2007 to below the reporting limit (BRL) of 0.01 µg/L in April 2009; a temporary increase in the EDB concentration to 0.028 µg/L was observed in January 2010 followed by a further decline in February 2011 when no EDB was detected. This decline may represent the migration of the trailing edge of the FS-28 plume deep lobe past this well location. • Generally stable EDB concentrations have been observed at the 69MW1306A,C at concentrations near the MMCL; EDB concentrations at this location are expected to decline further as the trailing edge of this plume lobe migrates south.



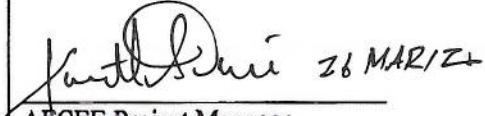
 AFCEE SPEIM/LTM/O&M Otis ANG Base, Massachusetts AFCEE 4P08 FA8903-08-D8769-300	PROJECT NOTE		TASK ORDER 0300
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ITEM	REMARKS
	<p><u>Shallow Leading Edge Lobe</u></p> <ul style="list-style-type: none"> No EDB has been detected at monitoring wells 69PZ0005B and 69PZ0019B located within the former shallow leading edge lobe since September 2007 (three consecutive annual sampling events); the need to continue monitoring this area will be assessed following the completion of the triennial SPEIM sampling event scheduled for spring 2012. <p><u>69EW0002 Performance Monitoring</u></p> <p>Performance monitoring data collected in the area of extraction well 69EW0002 were reviewed during the presentation. Declining EDB concentrations at monitoring wells 69MW0030A (0.017 µg/L in February 2011) and 69MW0029B (0.014 µg/L in February 2011); and no EDB detections at 69MW0031A and 69MW0032A,B all support the conclusion that the increase in flow rate at 69EW0002 from 50 gpm to 75 gpm on 07 October 2010 has improved plume capture by this extraction well. The decline in EDB concentrations at 69MW0028A (located hydraulically downgradient from 69EW0002) indicate that EDB concentrations in this uncaptured portion of the leading edge lobe are attenuating to concentrations below the MMCL.</p> <p><u>Surface Water Monitoring Network Optimization</u></p> <p>Based on no detections of EDB in Coonamessett River surface water since 2006, optimization of the surface water monitoring network was recommended which consisted of:</p> <ul style="list-style-type: none"> Elimination of monitoring at three locations south of Pond 14 (69SW0051, 69SW0052, 69SW2009); no EDB has been detected at these locations since September 1998. Elimination of monitoring at the former Romano bog (69SW2005) since the bog is no longer in production and is now owned by the Town of Falmouth 300 Committee and used as an open space wetland. A reduction in the monitoring frequency at the remaining 11 surface water locations to two times per growing season (from three times per growing season). Sampling will be conducted in June and August. The optimized surface water monitoring network is presented on Figure 4 and Table 1 in Attachment A. <p><u>ETD System Performance</u></p> <p>An overview of ETD system performance for the reporting period was also presented by providing treatment system influent concentration trends for 69EW0001 and 69EW0002, EDB mass removal, frequency of carbon exchanges, extraction well operational rates, volume of treated water, and electrical usage/air emissions associated with the operation of the system.</p> <p>Chemical and hydraulic data for the FS-28 plume have been collected through the SPEIM program since startup of the treatment system in 1997. This program was developed to monitor plume changes and to ensure the effective operation of the groundwater remediation systems;</p>

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ITEM	REMARKS
	<p>monitoring networks are also evaluated and optimized through the SPEIM program. The current approved FS-28 SPEIM monitoring network, including analytical scope and methods, is presented in the <i>Comprehensive Long Term Monitoring Plan</i> (CLTMP) available from AFCEE.</p> <p>Note that all the analytical data collected in 2010 for the FS-28 SPEIM program were reported in the <i>Fuel Spill-28 2010 Summary Letter Report</i> (AFCEE 2011) and the data collected in 2011 will be included in the <i>Fuel Spill-28 2011 Summary Letter Report</i> scheduled for submittal in March 2012.</p>
4.0	<p>CONCLUSIONS/RECOMMENDATIONS</p> <p>Conclusions</p> <p>Based on the SPEIM data summarized in the 11 May 2011 data presentation, the following conclusions can be drawn:</p> <ul style="list-style-type: none"> • SPEIM data continue to support the conclusion that 69EW0001 is successfully capturing the main FS-28 EDB plume. • The observed decline in influent EDB concentrations at 69EW0001 over the past several years is likely attributed to overall decline in EDB concentrations within the plume rather than an indication that the extraction well should be optimized; however, continued evaluation of performance monitoring data should be conducted. • No EDB was detected in monitoring wells screened shallow in the aquifer near the former SWP system; these data continue to support the decision for the interim shutdown of the SWP system in November 2008 and final shutdown in February 2010. • Monitoring data indicate improved capture of the deep leading edge lobe by 69EW0002 at the optimized flow rate of 75 gpm which was instituted on 07 October 2010; the data indicate that the remedial objective of capturing and cutting of this portion of the plume is being met. • An optimization of the surface water monitoring network is now appropriate based on the lack of EDB detections in the Coonamessett River since 2006. • ETD System performance monitoring data are consistent with the FS-28 conceptual site model, remedial goals are being met, and remediation is progressing as expected; no system operation, plume boundary, or Land Use Control boundary changes are needed at this time. <p>Recommendations</p> <p>Recommendations are as follows:</p> <ul style="list-style-type: none"> • Optimize the surface monitoring network as proposed in Figure 4 and Table 1 (Attachment A) • AFCEE will continue with the following planned SPEIM activities: <ul style="list-style-type: none"> ○ Perform the semiannual SPEIM sampling event in August 2011

 CH2MHILL AFCEE SPEIM/LTM/O&M Otis ANG Base, Massachusetts AFCEE 4P08 FA8903-08-D8769-300	PROJECT NOTE		TASK ORDER 0300
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ITEM	REMARKS
	<ul style="list-style-type: none"> ○ Perform the annual Coonamessett Water Supply Well sentry well sampling in October 2011 ○ Perform the triennial SPEIM sampling event in February 2012 ○ Perform routine monthly ETD system performance monitoring ○ Present sampling results at future Technical Update meetings
5.0	REGULATOR COMMENTS/ACTION ITEMS Verbal approval of the optimized surface water monitoring network was provided by the regulatory agencies at the 11 May 2011 Technical Update meeting; no other comments were received on the information presented during the FS-28 SPEIM data presentations or during a follow up discussion at the 29 September 2011 Technical Update meeting.
6.0	REFERENCE AFCEE. 2011 (March). <i>Fuel Spill-28 2010 Summary Letter Report</i> . 404929-SPEIM-FS28-SLR-001. Prepared by CH2M HILL for AFCEE/MMR, Installation Restoration Program, Otis Air National Guard Base, MA.
7.0	CONCURRENCE Concurrence with the optimized FS-28 SPEIM surface water chemical monitoring network (Figure 4 and Table 1 of Attachment A) is represented by the signatures below: <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;">  3/26/12 U.S. EPA Representative </div> <div style="text-align: center;">  3/26/2012 MassDEP Representative </div> </div> <div style="text-align: center; margin-top: 20px;">  26 MAR/12 AFCEE Project Manager </div> <p>Note: The parties involved will retain the ability to modify monitoring program based on field observations or other mutually agreeable technical justifications.</p>

Attachment:

Attachment A. FS-28 2011 Annual SPEIM Data Presentation, 11 May 2011 Technical Update Meeting

ATTACHMENT A

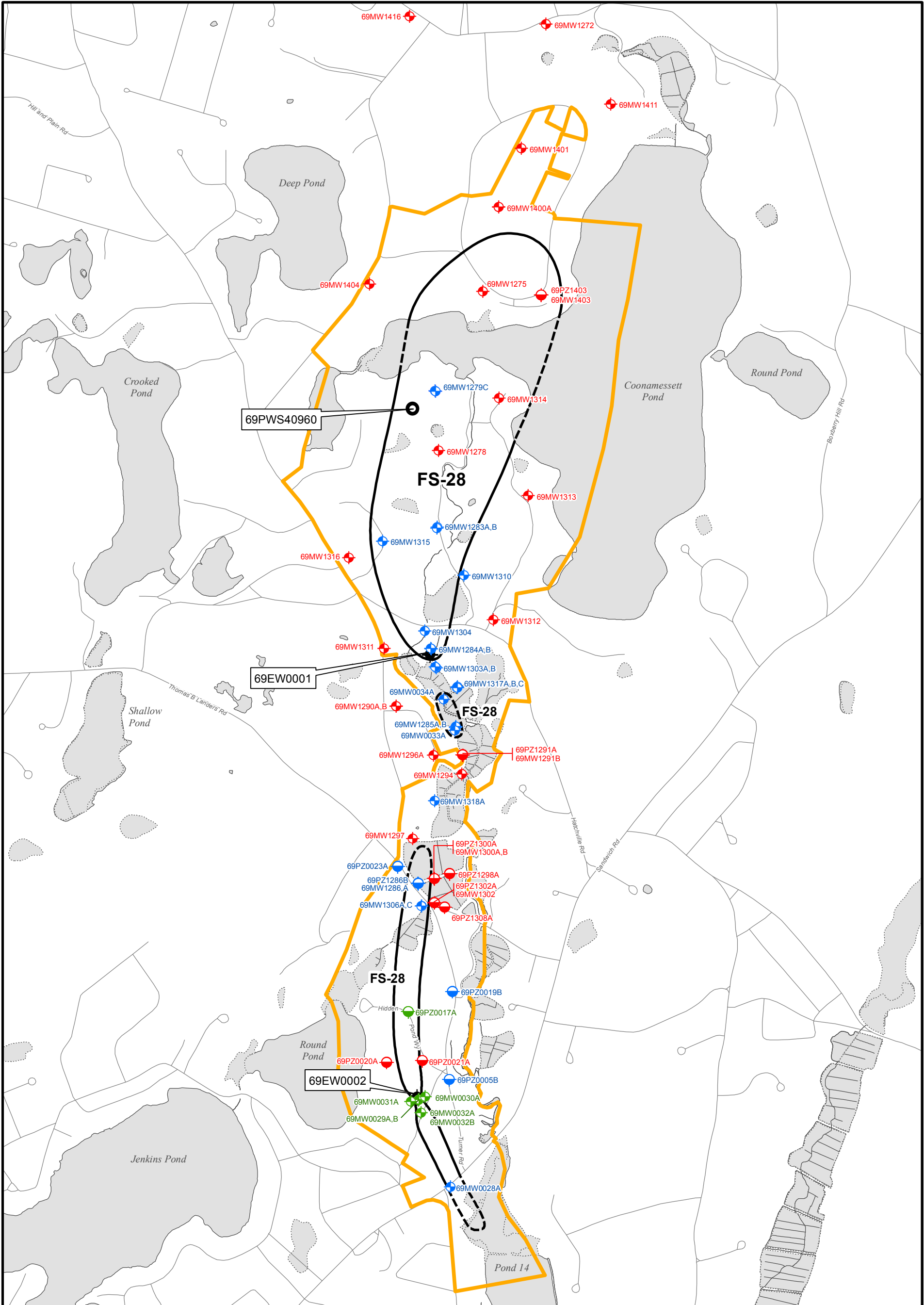
**FS-28 2011 Annual SPEIM Data Presentation,
11 May 2011 Technical Update Meeting**

FS-28 2011 Annual SPEIM Data Presentation

11 May 2011 Technical Update Meeting

Overview

- SPEIM groundwater sampling results
(locations shown on Figure 1)
 - Annual event in January/February 2011
 - » 33 regularly scheduled annual frequency wells
 - » 2 triennial frequency wells near 69EW0002 added
- Surface Water Network Optimization
- ETD System Performance Monitoring (Jan – Dec 2010)
- Conclusions and Recommendations
- No Sampling Deviations



Data Source: AFCEE, April 2011, MMR-AFCEE Data Warehouse

Legend

- | | | | |
|--|--------------------------|----------------------------|---|
| | Monitoring Well | | Plume Boundary
(Dashed Where Inferred) |
| | Piezometer | | Bog/Wetland |
| | Public Water Supply Well | Sampling Frequency: | |
| | Extraction Well | | Annual |
| | FS-28 LUC Boundary | | Semiannual |
| | | | Triennial |

FIGURE 1

**FS-28 SPEIM GROUNDWATER
CHEMICAL MONITORING NETWORK**
AFCEE - Massachusetts Military Reservation
11 May 2011 Technical Update Meeting

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FS-28 SPEIM Data Presentation

Groundwater Highlights

Main EDB Plume (Figures 1 and 2)

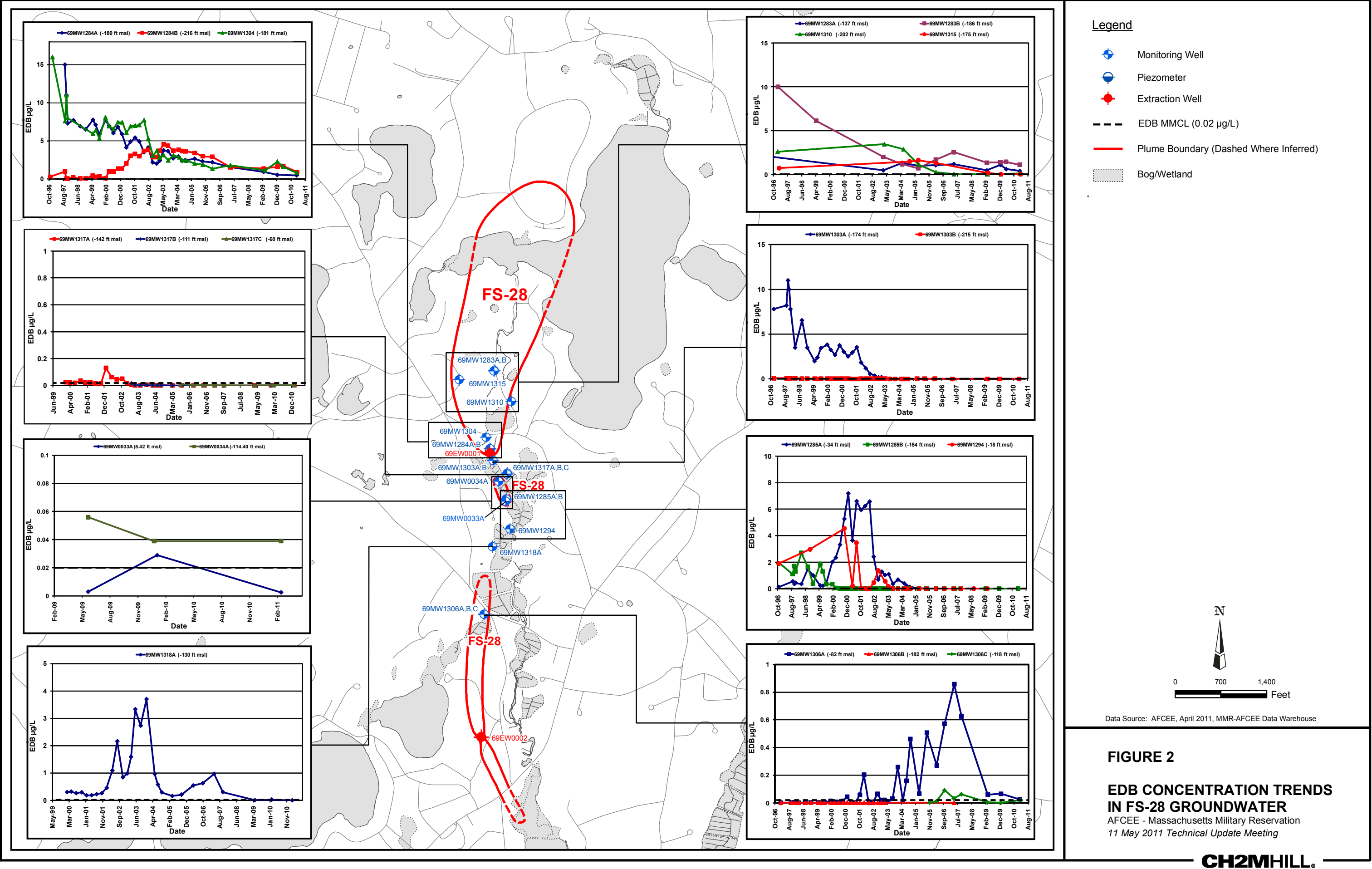
- EDB concentration trends at 7 key indicator wells in core of plume near 69EW0001

Monitoring Well LOC ID	EDB Concentration (µg/L)					
	April 2006	April 2007	March 2009	January 2010	May 2010 (resample)	February 2011
69MW1283A	1.05	1.18	0.464	1.09*	0.604	0.40
69MW1283B	1.68	2.54	1.33	1.39*	1.42	1.10
69MW1284A	2.19	1.56	0.931	0.524	NS	0.472
69MW1284B	2.89	1.53	1.38	1.60*	1.71	0.90
69MW1304	1.35	1.79	1.13	2.28*	1.60	0.811
69MW1310	0.256	0.025	0.013	0.028	NS	0.104
69MW1315	1.3	NS	0.148	0.028	NS	ND

Notes:

- 1) *EDB concentrations based on analysis of diluted samples
- 2) NS = not sampled
- 3) ND = not detected

- Long-term downward trend at majority of these indicator wells; EDB concentration fluctuations at wells located near plume boundary (69MW1310, 69MW1315)
- No EDB detections at 69MW1303 and 69MW1317 clusters continue to support conclusion that main EDB plume is being captured by 69EW0001



FS-28 SPEIM Data Presentation

Groundwater Highlights (cont.)

EDB data near Shallow Well Point (SWP) System (Figure 2)

- No EDB detections at shallow screens located near former SWP system
- EDB remains above MMCL at 69MW0034A screened deep in the aquifer
- Summary of recent monitoring data near former the SWP system:
 - 69MW0033A (shallow): EDB detected at BRL on 05 June 2009; 0.029 µg/L on 14 Jan 2010; ND on 18 Feb 2011
 - 69MW1285A (shallow) and 69MW1285B (deep) both ND on 04 Jan 2010 and 22 Feb 2011
 - 69MW0034A (deep): EDB detected at 0.056 µg/L on 05 June 2009; 0.039 µg/L on 14 Jan 2010; 0.039 µg/L on 18 Feb 2011
- No EDB detected in surface water collected from Coonamessett River since 2006
- Data continue to support decision to shutdown SWP System in November 2008.

FS-28 SPEIM Data Presentation

Groundwater Highlights (cont.)

Deep Leading Edge EDB Lobe (Figure 2)

- Highest EDB concentrations historically at 69MW1318A; steady decline from 3.7 µg/L in Dec 03 to 0.303 µg/L in Sept 07 to BRL in April 09; temporary increase above MMCL to 0.028 µg/L in Jan 2010; No EDB detected when sampled on 22 February 2011
- EDB concentration decline to ND at 69MW1318A may represent trailing edge of deep lobe has migrated past this location
- Recent stable EDB concentrations observed at 69MW1306 cluster near MMCL; expected to decline to ND as plume migrates south

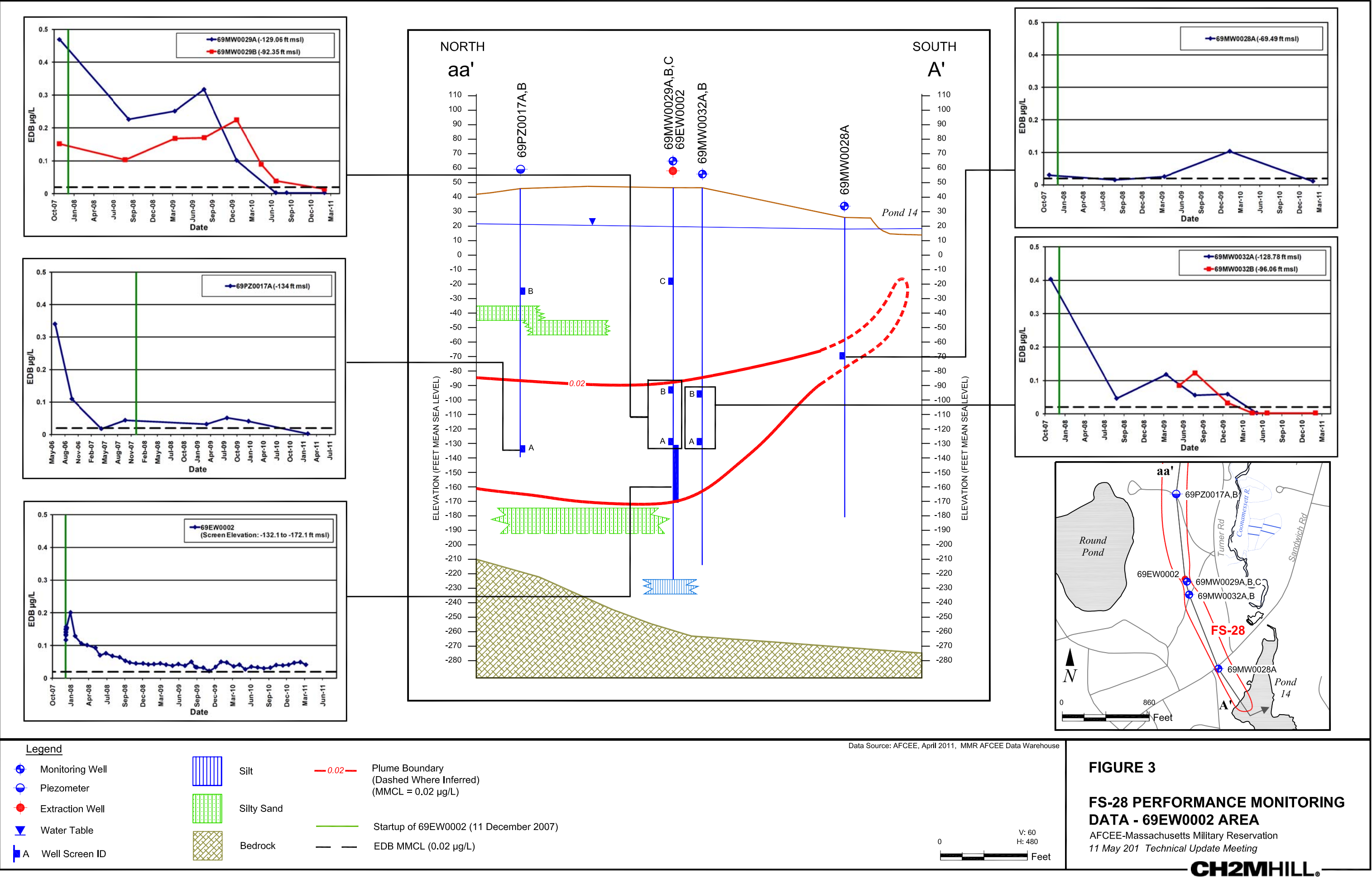
Former Shallow Leading Edge EDB Lobe

- No EDB detected during 2011 annual sampling event at 69PZ0005B and 69PZ00019B (Figure 1).
- No EDB detections in shallow lobe since September 2007 (3 consecutive annual sampling events)
- Assess need to continue monitoring based on results of triennial sampling event scheduled for Spring 2012

FS-28 SPEIM Data Presentation

Performance Monitoring Data – 69EW0002 (Figure 1 and 3)

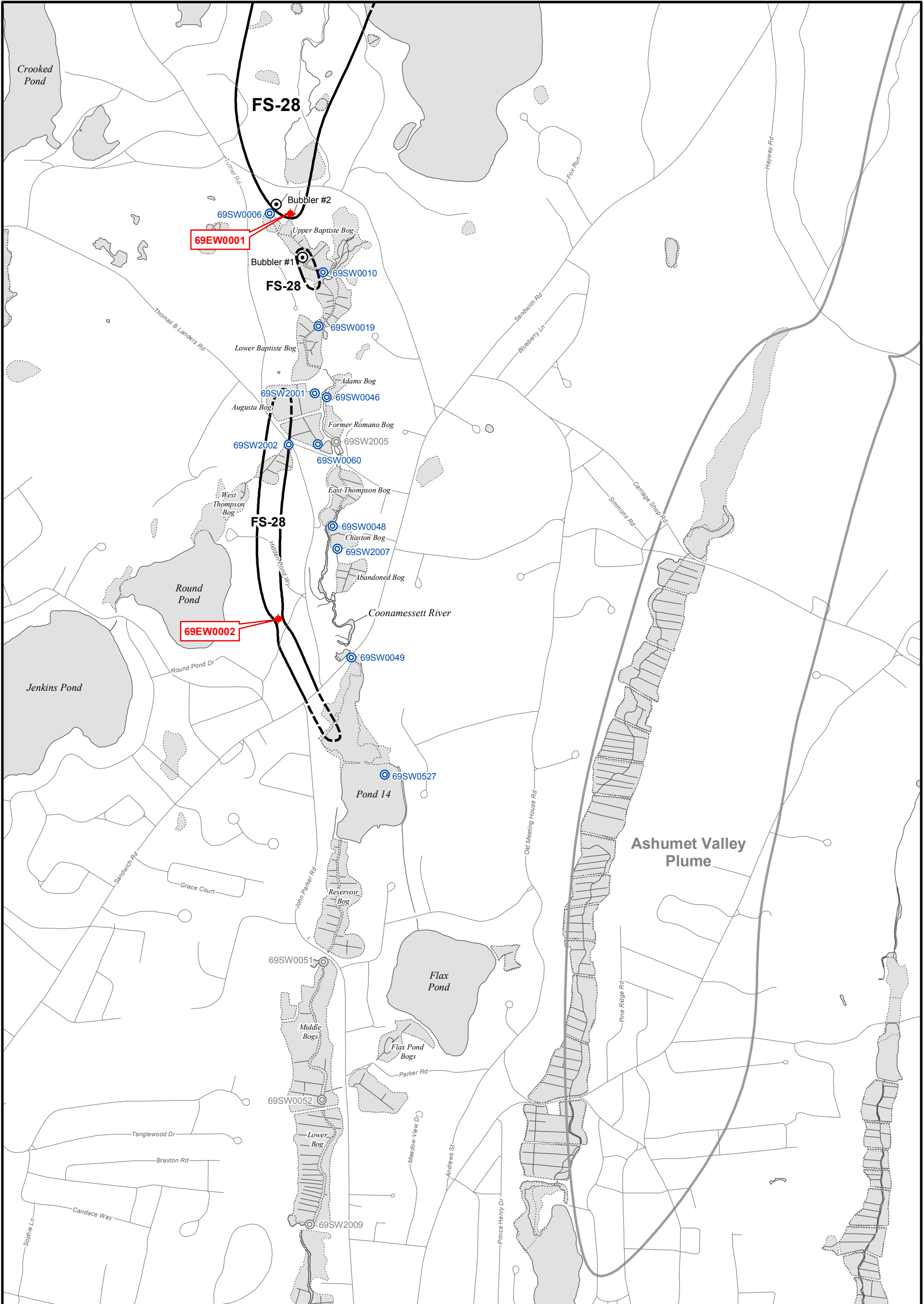
- No detections of EDB at flanking wells 69MW0030A and 69MW0031A between Aug 2008 and Jan 2010 indicated effective horizontal capture of the plume by 69EW0002
- However, EDB detected at 69MW0030A above MMCL on 12 Jul 2010 (0.042 µg/L) and on 31 Aug 2010 (0.067 µg/L); EDB remained ND at 69MW0031A
- Extraction rate at 69EW0002 increased from 50 gpm to 75 gpm on 07 Oct 2010 to increase extent of hydraulic capture
- EDB concentration at 69MW0030A declined to 0.017 µg/L on 18 Feb 2011; EDB remains ND at 69MW0031A; decline at 69MW0029B to below MMCL (0.014 µg/L)
 - Results support conclusion of improved capture by 69EW0002
- Continued EDB non-detects at 69MW0032A,B support conclusion that 69EW0002 is capturing and cutting off the plume
- Two screens in the core of the leading edge lobe (69PZ0017A and 69MW0029A) are now ND for EDB but influent concentrations at 69EW0002 remain stable
 - These data suggest that the plume is quite heterogeneous in this area with uneven boundaries and may even contain internal “holes”.
- EDB now sub-MMCL at downgradient well 69MW0028A (0.011 µg/L on 18 Feb 2011)
- No EDB detected at upgradient flanking wells 69PZ0020A and 69PZ0021A



FS-28 SPEIM Data Presentation

Surface Water Monitoring Network Optimization (Figure 4)

- No EDB detections in FS-28 Coonamessett River surface water since 2006
- Current FS-28 surface water monitoring network established in 2008 (Figure 4) and consists of:
 - 12 locations sampled 3 times during the growing season (May, July, September)
 - 3 locations sampled annually (south of Pond 14)
 - Data are used to monitor water quality and aid in cranberry crop marketability decisions
- Optimization Recommendations
 - Eliminate monitoring at 3 locations south of Pond 14 (69SW0051, 69SW0052, 69SW2009); No EDB has been detected since September 1998 at these locations
 - Eliminate monitoring at former Romano bog (69SW2005) since bog is no longer in production and is now owned by the Town of Falmouth 300 Committee as an open space wetland
 - Reduce monitoring frequency at remaining 11 locations to 2 times per growing season (June and August) consistent with approved monitoring approach at Ashumet Valley Backus River
- Optimized surface water monitoring network presented on Figure 4 and Table 1



Data Source: AFCEE, April 2011, MMR-AFCEE Data Warehouse

Legend



Extraction Well



Surface Water Sampling Location (Retained)



Surface Water Sampling Location (Removed)



Bubbler



Bog/Wetland



FS-28 Plume Boundary (Dashed Where Inferred)



0 590 1,180 Feet

FIGURE 4

OPTIMIZED FS-28 SPEIM SURFACE WATER CHEMICAL MONITORING NETWORK

AFCEE - Massachusetts Military Reservation
11 May 2011 Technical Update Meeting

CH2MHILL.

Table 1
Optimized FS-28 Surface Water Chemical Monitoring Network
11 May 2011 Technical Update Meeting

Location Identification	Coonamessett River North of Thomas B. Landers	Coonamessett River Between Thomas B. Landers and Pond 14.	Coonamessett River South of Pond 14	Pond 14	Adams Bog	Augusta Bog	Chaston Bog	Romano Bog*	Upper/Lower Baptiste Bog	East Thompson Bog	West Thompson Bog	Current Frequency	Proposed Frequency	Parameter
69SW0006	✓								✓			3 times per year during growing season	2 times per year during growing season	EDB
69SW0010	✓								✓			3 times per year during growing season	2 times per year during growing season	EDB
69SW0019	✓								✓			3 times per year during growing season	2 times per year during growing season	EDB
69SW0046	✓				✓							3 times per year during growing season	2 times per year during growing season	EDB
69SW0048		✓								✓		3 times per year during growing season	2 times per year during growing season	EDB
69SW0049		✓										3 times per year during growing season	2 times per year during growing season	EDB
69SW0051			✓									A	NM	NM
69SW0052			✓									A	NM	NM
69SW0060						✓						3 times per year during growing season	2 times per year during growing season	EDB
69SW0527				✓								3 times per year during growing season	2 times per year during growing season	EDB
69SW2001						✓						3 times per year during growing season	2 times per year during growing season	EDB
69SW2002											✓	3 times per year during growing season	2 times per year during growing season	EDB
69SW2005								✓				3 times per year during growing season	NM*	NM
69SW2007							✓					3 times per year during growing season	2 times per year during growing season	EDB
69SW2009			✓									A	NM	NM

Data Source: AFCEE, May 2011, MMR-AFCEE Data Warehouse

Notes:

Cranberry growing season is March through October; sampling proposed 2 times during growing season (June and August).

* Romano bog no longer in production - bog now wetland owned by the Town of Falmouth 300 Committee

Key:

A = annually

EDB = ethylene dibromide

NM = not monitored

FS-28 SPEIM Data Presentation

FS-28 Remedial System Performance Monitoring Data (Figure 5) (January 2010 – December 2010)

- 69EW0001 influent EDB concentrations ranged from 0.107 to 0.165 µg/L.

Average 69EW0001 Influent EDB Concentrations (µg/L)					
2005 (550 gpm)	2006 (550 gpm)	2007 (550 gpm)	2008 (550 gpm)	2009 (550 gpm*)	2010 (550 gpm)
0.383	0.307	0.244	0.196	0.159	0.134

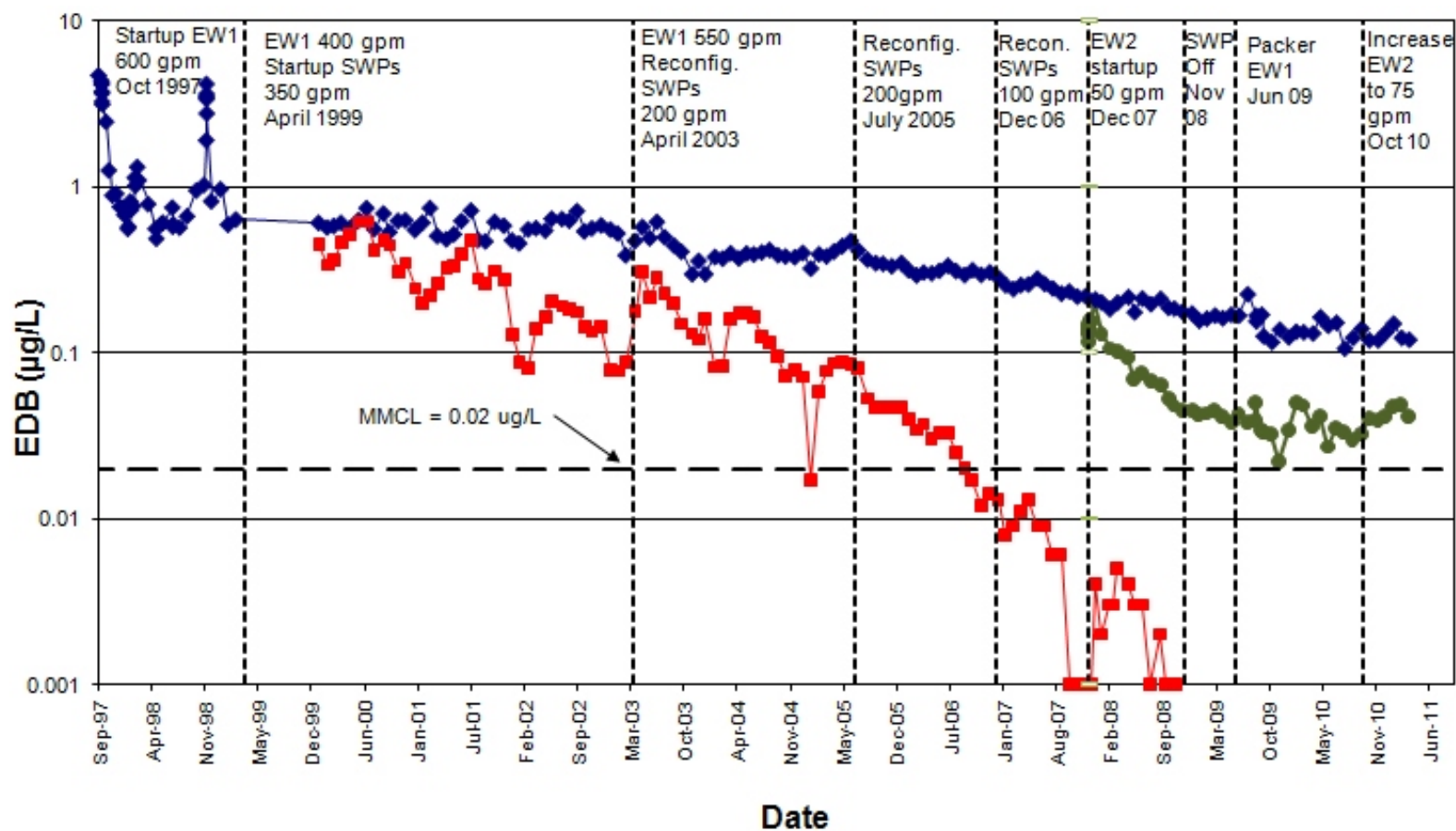
*Well packered on 11 June 2009; flow rate remained at 550 gpm

- Gradual downward trend in average influent concentrations at 69EW0001 primarily attributed to decline in EDB concentrations in core of main plume.
- 69EW0002 influent EDB concentrations ranged from 0.027 to 0.050 µg/L.

Average 69EW0002 Influent EDB Concentrations (µg/L)		
2008 (50 gpm)	2009 (50 gpm)	2010 (75 gpm*)
0.075	0.038	0.038

*Flow rate increased from 50 to 75 gpm on 07 October 2010

- Stable average influent EDB concentration at 69EW0002 in 2009/2010 even with observed heterogeneity within plume and increase in flow in Oct 2010.
- Data supports recommendation to continue to operate ETD system under current configuration (2010 Scenario 01) and continue to monitor performance.



Data Source: AFCEE, April 2011, MMR-AFCEE Data Warehouse

Legend

- ◆ 69EW0001
- 69PLT01023 (Shallow Wellpoint Combined Influent)
- 69EW0002
- MMCL = 0.02 µg/L

FIGURE 5

FS-28 REMEDIAL SYSTEM INFLUENT EDB CONCENTRATION TRENDS

AFCEE - Massachusetts Military Reservation
11 May 2011 Technical Update Meeting

FS-28 SPEIM Data Presentation

FS-28 Remedial System Performance Monitoring Data (January 2010 – December 2010)

- Mass Removal: 0.317 pounds of EDB removed (Jan 10 – Dec 10)
 - 0.308 pounds (97.2%) EDB removed by 69EW0001 (91% of system flow)
 - 0.009 pounds (2.8%) EDB removed by 69EW0002 (9% of system flow)
- Well Performance
 - 69EW0001 operated at 96% of design flow of 550 gpm
 - 69EW0002 operated at 96% of design flow of 50 gpm (increased to 75 gpm on 07 October 2010)
- 3 carbon exchanges during 2010 (15 April, 18 August, 11 November)

FS-28 Remedial System Electrical Consumption and Associated Air Emissions

		1/1/2010 to 12/31/2010	System Startup (11/1997) to 12/31/2010
Volume of Groundwater Treated (million gallons)		305	4,609
Groundwater EDB Mass Removal (pounds)		0.317	14.483
Electrical Usage (MWh)		411	6,819
Estimated Air Emissions ¹ (based on electrical usage)	CO ₂	269	5,605
	NO _x	580	8,691
	PM-10	33	318
	SO ₂	1,545	9,484
	VOCs	20	412
Estimated Reduction in Air Emissions due to Green Power Purchases ²	CO ₂	135	377
	NO _x	290	709
	PM-10	17	35
	SO ₂	775	1,450
	VOCs	10	28
Estimated Reduction in Air Emissions due to MMR Wind Turbine Operation ³	CO ₂	38	44
	NO _x	82	94
	PM-10	4.7	5.4
	SO ₂	218	250
	VOCs	2.9	3.3
Estimated Total Air Emissions with consideration of Green Power Purchases and MMR Wind Turbine Operation	CO ₂	96	5,184
	NO _x	207	7,888
	PM-10	12	278
	SO ₂	553	7,784
	VOCs	7	381

Notes:

1) The estimated air emissions presented in this table are based on the assumption that until 4/30/2009, the power used to operate the MMR remedial systems was provided by the Canal Power Plant in Sandwich, MA. This power plant primarily produced electricity generated by the combustion of fuel oil and has been off-line since 5/1/2009. Starting on 5/1/2009, air emissions are based on electricity generated by the average mix of power sources in Massachusetts. Air emissions were calculated using MMR utility data from AFCEE's Metrix 4 Utility Accounting Software (<http://www.abraxasenergy.com/metrix4.php>) and emission factors obtained from the following websites:

<http://www.csgnetwork.com/elecpowerpolcalc.html>

<http://www.metrixcentral.com/EmissionsCalculator/Emissions%20Factors%202004.pdf>

2) Emissions offset by purchases of electricity from renewable sources beginning 7/1/2008.

3) Emissions offset by operation of AFCEE-owned wind turbine beginning on 12/2/2009.

FS-28 SPEIM Data Presentation

Conclusions

- SPEIM data continue to support conclusion that 69EW0001 continues to capture the main FS-28 EDB plume.
- The observed decline in 69EW0001 influent concentrations over past several years likely attributed to overall decline in EDB concentrations within the plume.
- Wells screened shallow in the aquifer near former SWP system all ND for EDB; data continue to support decision to cease operation of SWP system in November 2008.
- Monitoring data indicate improved capture of the deep leading edge lobe by 69EW0002 at optimized flow rate of 75 gpm; remedial objective of capturing and cutting of this portion of the plume is being met.
- Surface water monitoring network optimization appropriate based on lack of EDB detections in Coonamessett River since 2006; proposed fewer sampling locations & reduced frequency.
- ETD System performance monitoring data consistent with CSM, remedial goals are being met, and remediation is progressing as expected; no system operation, plume boundary, or LUC boundary changes needed at this time.

FS-28 SPEIM Data Presentation

Recommendations

- Optimize the surface monitoring network as proposed – next sampling event in June 2011
- AFCEE will continue with following planned SPEIM activities:
 - Perform semiannual SPEIM sampling event in August 2011
 - Perform annual Coonamessett Water Supply Well sentry well sampling in Oct. 2011
 - Perform triennial SPEIM sampling event in February 2012
 - Perform routine monthly remedial system performance monitoring
 - Present sampling results at Technical Update meetings